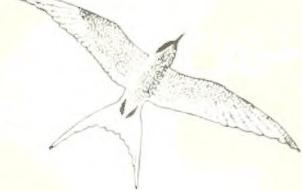




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GIFT OF

Marcia Brady Tucker

Father
From Andrew & Mary
Christmas 1870.

GROUP OF BRITISH MOTHS.



No 1 *Cyathophora Jacobaeæ*
No 2 *Arctia dominula*
No 3 *Nemophila pluto*
No 4 *Arctia Russula*
No 5 *Arctia Cata (Var.)*

No 6 *Arctia caja*
No 7 *Arctia villica*
No 8 *Arctia cata (Var.)*

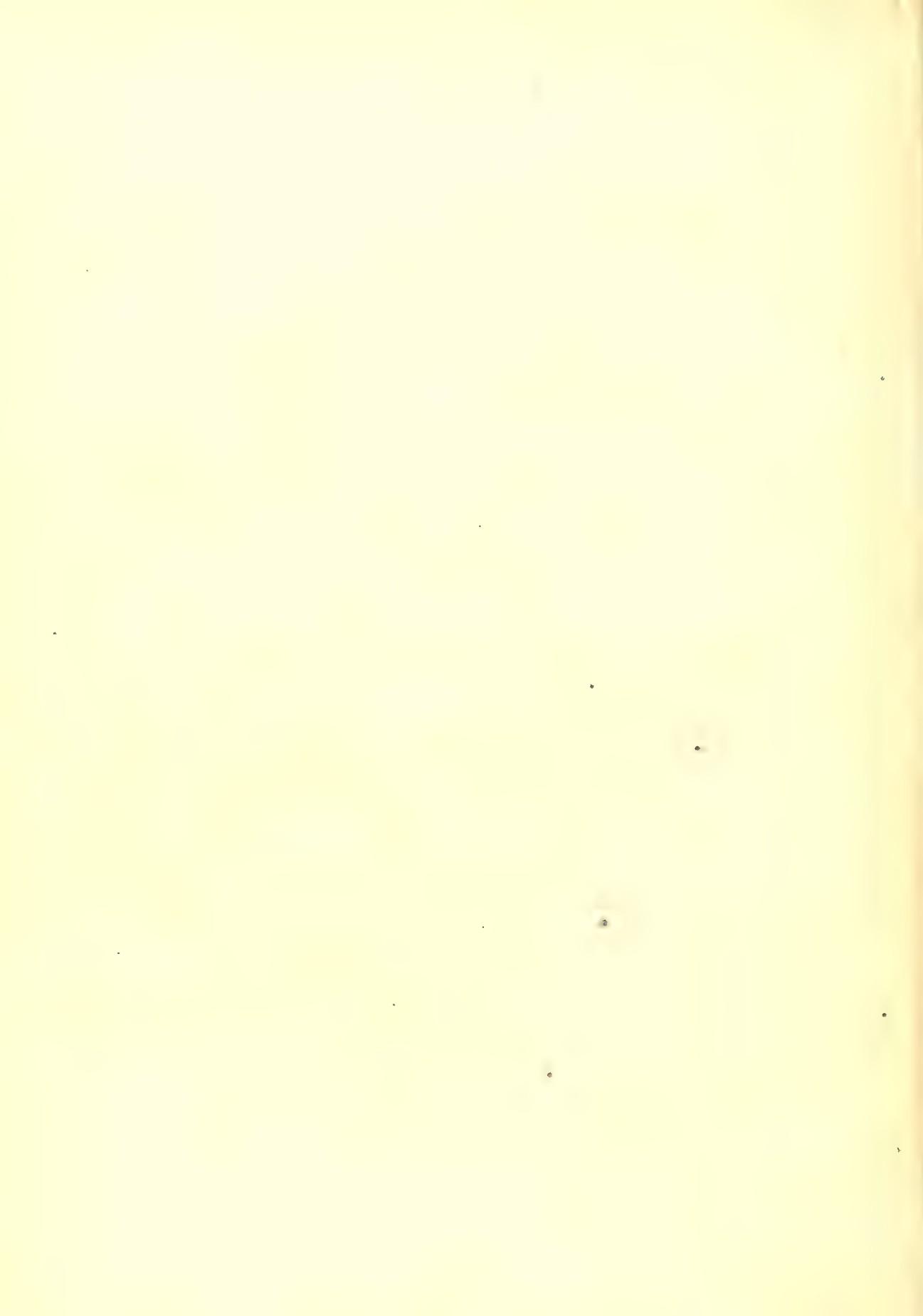
THE
LIVING



Vol. 2.

CHESTNUT

Samuel Walker & Co. Boston



THE
LIVING WORLD:
CONTAINING DESCRIPTIONS OF
THE SEVERAL RACES OF MEN,
AND ALL SPECIES OF
ANIMALS, BIRDS, FISHES, INSECTS,
ETC., ETC.
With Numerous Anecdotes,
ILLUSTRATIVE OF THEIR
INSTINCTS, REASONING POWERS, AND DOMESTIC HABITS.

BY
AUGUSTUS C. L. ARNOLD, LL.D.,
AUTHOR OF "A PHILOSOPHICAL DICTIONARY," ETC.
ASSISTED BY
EDWARD A. SAMUELS, Esq.,
AUTHOR OF "ORNITHOLOGY OF NEW ENGLAND," ETC.

VOL. II.

Nature is a book written on both sides, within and without, in which the finger of God
is plainly visible.—FRED. VON SCHLEGEL.

BOSTON:
SAMUEL WALKER & CO.
1868.

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A V E S (B I R D S).

CONTINUED.

ORDER CLAMATORES. SCREAMERS.

FAMILY BOMBYCILLID.E. WAX-WINGS.

THE Bombycillidæ, of which the Bohemian Chatterer or Wax-Wing (*Amphelis garrulus*) is the type, are placed in the above order, although they are provided with the singing apparatus of the *Oscines*.

The Bohemian Chatterer is widely distributed on both continents, and is generally known. It breeds in the most northern sections, but in severe winters moves southwards. It congregates in flocks in these migrations, and is a social, unwary bird. Its food consists of berries of various sorts, insects, seeds, &c. In confinement, it will not refuse anything edible, but seems to prefer fruits. In plumage, it is one of the most beautiful of birds, being a vinous-ash color above, and lighter beneath; the feathers of the head are prolonged into a crest; the throat, the feathers around the nostrils, and a stripe, which passes from the beak to the back of the neck, are black. The secondaries of the wings are tipped with white, each having the shaft prolonged, and furnished with a small, scarlet, horny appendage. The tail is black, tipped with a yellow band.

FAMILY ALAUDID.E. THE LARKS.

In this group are comprehended the true larks, of which the Skylark (*Alauda arvensis*) is the type. Although provided with the singing apparatus, these birds, for the reasons given in our remarks on the Chatterers, are placed in the Clamatores.

The Skylark is spread generally over Europe, several parts of Asia, and of Africa. It is thus described:—

"No bird sings with more method: there is an overture performed *vivace crescendo*, while the singer ascends; when at the full height, the song becomes *moderato*, and distinctly divided into short passages, each repeated three or four times over, like a *fantasia*, in the same key and time. If

there be any wind, he rises perpendicularly by bounds, and afterwards poises himself with breast opposed to it. If calm, he ascends in spiral circles; in horizontal circles during the principal part of his song, and zigzagly downwards during the performance of the *finale*. Sometimes, after descending about half way, he ceases to sing, and drops with the velocity of an arrow to the ground. Those acquainted with the song of the Skylark can tell, without looking at them, whether the birds be ascending or stationary in the air, or on their descent, so different is the style of the song in each case. In the first, there is an expression of ardent impatience, in the second, an *andante*, and in the last, a graduated sinking of the strains, often touching the subdominant before the final close. The time and number of the notes often correspond with the vibrations of the wings; and, though they sometimes sing while on the ground, as they seem to do in cages, their whole frame seems to be agitated by their musical efforts."

This is one of the earliest spring birds of song, and continues its warblings for the whole summer months, but becomes quite mute in winter, and is one of the few birds which chant on the wing. It sings with greatest energy in the morning, and has been the theme of poets in all ages, and is, perhaps, more listened to during its aerial flights than almost any other bird.

The Lark makes its nest on the ground, between two clods of earth, or scrapes a hollow cavity in the soil, and there deposits four dirty-white eggs, which are blotched and spotted with brown. It commences the business of incubation early in May, and if its first nests are destroyed, will lay so late as September. Mr. Jesse asserts that when the Lark is disturbed while incubating, it will remove its eggs from its nest to a place of greater security; "and this transposition," says he, "I have observed to be effected in a very short space of time. When one of my mowers first told me that he had observed the fact, I was somewhat disinclined to credit it; but I have since ascertained it beyond a doubt, and now mention it as another strong proof of that order in the economy of nature, by means of which this affectionate bird is enabled to secure its forthcoming offspring. I call it affectionate, because few birds show a stronger attachment to their young." He adds, "Since this was written, I have had a further opportunity of observing the fact respecting the Larks removing their eggs; and a friend informed me that when he was recently in Scotland, a shepherd mentioned having witnessed the same circumstance."

This bird sits only fifteen days, and usually produces two broods in a year. As soon as the young have escaped from the shell, the attachment of the parent bird seems to increase; she flutters over their heads, directs all their motions, and is ever ready to screen them from danger. This instinctive

warmth of attachment often discovers itself, even before she is capable of becoming a mother, which might be supposed to precede, in the order of nature, the maternal solicitude, as thus finely exemplified by Buffon :—

"A young hen bird," says he, "was brought to me in the month of May, which was not able to feed without assistance. I caused her to be educated, and she was hardly fledged, when I received from another place a nest of three or four unfledged Skylarks. She took a strong liking to these newcomers, which were scarcely younger than herself; she tended them night and day, cherished them beneath her wings, and fed them with her bill. Nothing could interrupt her tender offices. If the young ones were torn from her, she flew to them as soon as she was liberated, and would not think of effecting her own escape, which she might have done a hundred times. Her affection grew upon her; she neglected food and drink; she now required the same support as her adopted offsprings, and expired at last, consumed with maternal anxiety. None of the young ones survived her. They died one after another, so essential were her cares, which were equally tender and judicious."

FAMILY UPUPIDÆ. THE HOOPES.

In this family are two sub-families, thus distinguished :—

UPUPIDÆ. Claw of hallux (hind toe) strongly incurved; head without crest IRRISORINÆ.
almost straight; head with crest UPUPINÆ.

Gray says of the genus *Upupa*, the typical genus of the *Upupinæ*, —

"The species that compose this genus are found in Europe, Asia, and Africa. They are migratory, and prefer low and moist situations that border woods and forests: it is in such places that they search for insects and worms. They also seek for their food on the trunks of trees, and especially among the foliage for caterpillars; and they may sometimes be observed hanging from a branch while reaching one of them from a leaf. Even manure is examined by these birds for the insects that it contains. The nest is generally placed in holes of decayed trees, and occasionally in crevices of walls and rocks. The material employed consists of dry grass, and the nest is usually lined with feathers, or other soft articles, internally. The female deposits four or five eggs."

The same author says of *Irrisor*, the type of the *Irrisorinæ*, —

"The species of this genus are found throughout the entire continent of Africa. They frequent the tall trees, creeping among the branches while in search of their food, which consists almost entirely of insects and their larvae; they also feed on the fruits of the fig trees when ripe; and should they, while thus engaged, be disturbed, they commence uttering a loud, chattering noise. It is further stated that they congregate in small flocks, and roost in the holes of trees."

We will here include a family not mentioned by Lilljeborg, viz., the Menuridae.

FAMILY MENURIDÆ. THE LYRE BIRDS.

We are indebted to the writings of Mr. Gould, the eminent British naturalist, for the following very complete account of these birds:—

"In the structure of its feet, in its lengthened claws, and in its whole contour, the Lyre Bird presents the greatest similarity to the *Pteroptochos megapodus* of Kittlitz; another singular circumstance, by which their alliance is rendered still more evident, is the fact that *Pteroptochos* differs from the other families of the Insectorial order in having fourteen feathers in its tail, and that *Menura* also differs in the same particular in possessing sixteen. The immense feet and claws of these two birds admirably adapt them for the peculiar localities they are destined to inhabit, and the same beautiful modification of structure is observable in the other genera, equally adapting them for the situations they are intended to fulfil. Thus the *Menura* passes with ease over the loose stones and the sides of rocky gullies and ravines, while the *Muluri* trip over the more open and even ground, and the *Dasyorni*, with equal facility, thread the dense shrubs and reed-beds.

"The great stronghold of the Lyre Bird is the colony of New South Wales, and from what I could learn, its range does not extend so far to the eastward as Moreton Bay; neither have I been able to trace it to the westward of Port Philip, on the southern coast; but further research can alone determine these points. It inhabits equally the bushes on the east, and those that clothe the sides of the mountains in the interior: on the coast it is especially abundant at the Western Port and Illawarra; in the interior, the cedar brushes of the Liverpool range, and according to Mr. G. Bennett, the mountains of the Tumat country are among the places of which it is a denizen.

"Of all the birds I have ever met with, the Menura is far the most shy and difficult to procure. While among the mountains I have been surrounded by these birds, pouring forth their loud and liquid calls for days together, without being able to get a sight of them; and it was only by the most determined perseverance and extreme caution that I was enabled to effect this desirable object, which was rendered more difficult by their often frequenting the almost inaccessible and precipitous sides of gullies and ravines, covered with tangled masses of creepers and umbrageous trees: the cracking of a stick, the rolling down of a small stone, or any other noise, however slight, is sufficient to alarm it; and none but those who have traversed these rugged, hot, and suffocating brushes, can fully understand the excessive labor attendant on the pursuit of the Menura. Independently of climbing over rocks and fallen trunks of trees, the sportsman has to creep

and crawl beneath and among the branches with the utmost caution, taking care only to advance when the bird's attention is occupied in singing, or in scratching up the leaves in search of food. To watch its action, it is necessary to remain perfectly motionless, not venturing to move even in the slightest degree, or it vanishes from sight as if by magic. Although I have said so much on the cautiousness of the Menura, it is not always so alert; in some of the more accessible brushes, through which roads have been cut, it may frequently be seen, and on horseback, even closely approached, the bird evincing less fear of those animals than of man.

"The Lyre Bird is of a wandering disposition, and although it probably keeps to the same brush, it is constantly engaged in traversing it from one end to the other, from the mountain base to the top of the gullies, whose steep and rugged sides present no obstacle to its long legs and powerful, muscular thighs: it is also capable of performing extraordinary leaps, and I have heard it stated that it will spring ten feet perpendicularly from the ground. Among its many curious habits, the only one at all approaching to those of the Gallinaceæ is that of forming small, round hillocks, which are constantly visited during the day, and upon which the male is continually tramping, at the same time erecting and spreading out its tail in the most graceful manner, and uttering its various cries, sometimes pouring forth its natural notes, at others mocking those of other birds, and even the howling of the native dog (Dingo). The early morning and the evening are the periods when it is most animated and active.

"The food of the Menura appears to consist principally of insects, particularly centipedes and coleoptera; I also found the remains of shelled snails in the gizzard, which is very strong and muscular.

"I regret that circumstances did not admit of my acquiring a perfect knowledge of the nidification of this very singular bird. I never found the nest but once, and this unfortunately was after the breeding season was over; but all those of whom I made inquiries respecting it, agreed in assuring me that it is either placed on the ledge of a projecting rock, at the base of a tree, or on the top of a stump, but always near the ground; and a cedar-cutter, whom I met in the brushes, informed me that he had once found a nest, which was built like that of a magpie, adding, that it contained but one egg. The natives state that the eggs are two in number, of a light color, freckled with spots of red. The nest seen by myself, and to which my attention was drawn by my black companion Natty, was placed on the prominent point of a rock, in a situation quite secluded from observation behind, but affording the bird a commanding view and an easy retreat in front; it was deep, and shaped like a basin, and had the appearance of having been

roofed; was of a large size, formed outwardly of sticks, and lined with the inner bark of trees and fibrous roots."

FAMILY ERIODORIDÆ. BUSH SHRIKES AND ANT THRUSHES.

In this group are included three sub-families, characterized as follows:—

<i>ERIODORIDÆ.</i>	{ covered with scutellæ. Bill { high and stout, like that of <i>Lanius</i> . <i>THAMNOPHILINÆ.</i>	
Outer side of tarsus		{ weak, like that of <i>Turdus</i> <i>MYIOTHERINÆ</i> . covered with an entire plate. <i>HYPOCNEMIDINÆ</i> .

The *Thamnophilinæ*, or Bush Shrikes, are found on both continents. Gray says of the typical genus *Thamnophilus*,—

"Most of these birds are inhabitants of the tropical parts of America. They usually reside in the vast forests, seeking the foliage of the low bushes and the trunks of trees for the insects on which they subsist. The nests are usually placed in the thick bushes, at no great distance from the ground; the exterior is attached by strong filaments to the boughs, which form a fork at the extremity of a slender branch; the interior is furnished with hairs and delicate stems of plants. Some species compose it of a series of small, spinous branches, slightly put together. The eggs are from two to five in number."

The Ant Thrushes (*Myiotherinæ*) are a singular group of birds. By some authors, they are made a sub-family of the *Formicariinæ*, while others place them in the *Turdidæ*. The following account of these birds, and their nearly-allied species, will give a good idea of their characteristics:—

"Under the name of *Myiotheræ*, Illiger and Cuvier have united several genera, composing the *Breves* of Buffon, and the Ant Thrushes, properly so called. The Breves are remarkable for the vivid and strongly-contrasted hues of their plumage, for the length of the legs, and the shortness of the semi-erect tail. They are only found in India and the adjacent islands, and Australia, whilst the Ant Thrushes belong to the New World as well as the Old. The Breves have the gradually-curved bill of the true thrushes, but much stronger; the wings are short, and the powers of flight feeble. The predominant color is metallic green, variegated with azure blue, scarlet, and black; and some species, with a hood of the latter tint, appear to be confined to Australia and the neighboring islands of the Indian Seas. The Ant Thrushes, principally confined to tropical America, represent the Breves in that portion of the world, but differ from those splendid birds in having a more abruptly-hooked bill and more soberly-colored plumage."

The utility of the Ant Thrushes, in their native localities, is thus commented upon by Mr. Swainson:—

"Of all the tribe of insects which swarm in the tropics, the ants are the most numerous; they are the universal devastators, and in the dry and over-

grown forests of the interior the traveller can scarcely proceed five paces without treading upon their nests. To keep these myriads within due limits, a wise Providence has called into existence the Ant Thrushes, and has given to them this particular food. Both are proportionate in their geographical range, for beyond the tropical latitude the ants suddenly decrease, and their enemies, the Ant Thrushes, totally disappear. As a general distinction by which this family may be known from the Bush Shrikes, we may mention the difference in the feet, the structure of one being adapted for walking, while that of the other is more suited for perching. The Ant Thrushes are very locally distributed; for, although the group is tropical, we frequently found that a particular species, very common in one forest, was replaced in another by a second; while a third locality, in the same district, would present us with still another kind, different from those we had previously found. Cayenne and Surinam, in like manner, furnish us with many species totally unknown in the forests of Brazil."

FAMILY TYRANNIDÆ. TYRANT FLYCATCHERS.

This family is divided into two groups, which are distinguished as follows :—

The *Fluvicoline*, or Waterchats, as stated by Mr. Swainson, are, with the exception of one genus, entirely restricted to the warm latitudes of South America, where they seem to represent the Stonechats and the Wagtails of the Old World. - "They are," says this author, "strictly ambulating Fly-catchers, and constitute the rassorial division of this family. The legs are consequently very long, and formed especially for walking; the toes are also long, quite divided to their base, and furnished with long, slightly-curved claws. This structure enables these birds to run with great celerity; and they are generally seen on the sides of streams and rivers, feeding on flying insects, which resort to such situations; for they never hunt among trees, and rarely perch,—such, at least, are the manners of the typical species."

Mr. Swainson is of the opinion that these birds seem to connect the Tyrant Shrikes with the Flycatchers, which last birds constitute a group hardly less numerous than that of the Warblers, and composed, like them, almost entirely of small birds.

Of the *Tyranninæ*, or Tyrant Flycatchers, there are many species contained in some seven genera. They are restricted to the American continent, and many of them are well known,—such as the King Bird, Fork-tailed Flycatcher, &c.

Our limits will not permit an extended review of this group. "The Water-chats" (*Fluvicolinae*), says Mr. Swainson, "which seem to connect the Tyrant Shrikes to the fly-catching family, or the *Muscicapidae*, like very many other tribes, have their plumage black and white, variously blended, but without any mixture of green. The lesser Tyrants (*Tyrannulae*), on the contrary, are all of an olive-colored plumage; that color, in short, which is most adapted for concealment among foliage, and therefore suited to their mode of life. Between these, however, we find some curious birds, which borrow the habits of both groups. The species, called by Latham White-headed Tody, for instance, is black and white; its general resort is on the sides of marshes, where it perches upon the reeds, and darts on passing insects in the same manner as a true Tyrant Shrike. The lesser Tyrants (*Tyrannulae*) are spread over the whole of America, where they represent the true Flycatcher (*Muscicapa*) of the Old World; both have nearly the same manners; and so closely do they resemble each other, that they can only be distinguished by their feet, tail, and wings. From these we may pass to the true or greater Tyrants by a little sub-generic group (*Mileulus*), having very long forked tails. The habits of the typical Tyrants intimately resemble those of the lesser, but they feed upon larger insects more suited to their own size: some imitate the Kingfishers, by diving in the water; and they will even prey upon small reptiles. The species, which are numerous, swarm in tropical America, where they are everywhere seen perched upon naked branches, and uttering at short intervals a sharp and monotonous cry. The Tyrants are bold and quarrelsome birds, particularly during the season of incubation; the male will not then suffer any birds to come near its nest, and becomes so infuriated against such unconscious intruders, that it will attack both hawks and eagles, with a determination not to be resisted, until they are fairly driven away."

FAMILY PLATYRYNCHIDÆ. THE BROAD BILLS.

The birds composing this group have occupied uncertain and varied positions in the writings of various authors. Most ornithologists have placed them in the *Muscicapidae*.

The following remarks explain somewhat the causes for their being placed in this position:—

"Mr. Vigors, at the commencement of the section treating of the order *Dentirostres*, observes that the depressed bill and insect-food of the *Turdidae* introduce us at once to the *Muscicapidae*, with which they are immediately connected by the genus *Platyrynchus*. The species that compose the latter group (*Platyrynchus*) were separated from it only on account of the comparative strength of their legs. The whole of the *Muscicapidae*,

indeed," continues Mr. Vigors, "with which family *Platyrynchus* is now united, have a decided affinity to the last tribe, or the birds which feed upon the wing, in their broad-based bills, the vibrissæ that surround them, and their similar habits of darting upon their prey while on the wing."

FAMILY PIPRIDÆ. THE MANAKINS.

Mr. Swainson regards the *Pipridæ*, or, as he calls them, *Piprinæ*, as a sub-family of the Ampelidæ, from which they differ in the slenderness of the feet, shortness of the beak, and curvature of the upper mandible; most are of small size, and clothed in plumage of the richest tints of crimson, orange, yellow, blue, green, and black. The warmer regions of America are their strongholds, but not their exclusive *habitat*. According to Mr. Swainson, the Manakins "chiefly occur in the deep virgin forests of the tropics, but are much more social than the *Cotingas*. They live in little bands; are continually in motion, and feed almost entirely on the large, soft berries of the different species of *Melastoma*; the nest of one species, *Pipra pareola*, is often built in the fork of a shrub, in such an exposed manner, that the female can look all round, and watch the approach of danger. We found one in such a situation in the forest of *Pitanga*, a single leaf of a large pepper plant (*Piper*) forming a kind of umbrella shade over the female, which was sitting, and did not rise from her nest as we passed onwards."

FAMILY PHYTOTOMIDÆ. THE PLANT CUTTERS.

Some ornithologists place the Plant Cutters, the Colies, the *Touracos*, and the Plantain-eaters under one family head, of which they constitute so many distinct tribes. We are inclined, however, to regard them as the types of distinct forms, that is, constituting so many family sections."

Of these birds the Chilian Plant Cutter (*Phytotoma rara*) is one of the best known.

To Molina we are principally indebted for our knowledge of the habits of this bird, which, from the depredations it commits, is subject to incessant persecution. It feeds on plants of the most tender nature, cutting them off close to the roots; and not content with merely satisfying its appetite, it has the most destructive habit of cropping close a quantity of them without touching them further, thus injuring the fields of rising grain, while the blade is peeping above the surface.

The Chilian Plant Cutter builds its nest on the most lofty trees, in obscure and but little frequented spots, and, consequently, generally rears its young brood in safety, notwithstanding the reward which Molina says is (or in his time was) given to children and other persons who destroy the eggs.

The same writer states that its numbers were, in his time, considerably diminished, and adds,—

"I do not know whether this circumstance is because a price is set on its head, or on account of its naturally small degree of fecundity."

In size, this bird nearly equals a thrush; its bill is rather large, straight, conical, and with the edges serrated; the tail is moderate and rounded. The color is dusky-gray upon the back, rather clearer on the under surface; the points of the quills and the tail are black. Its voice is a hoarse, interrupted note.

FAMILY AMPELIDÆ. THE CHATTERERS.

The group is divided as follows:—

AMPELIDÆ. { thick and convex, not compressed; second primary abbreviated in the males. *PSARINÆ.*
Bill { broad at base, compressed towards tip; second primary not abbreviated. . . *AMPELINEÆ.*

The *Ampelinae* of Lilljeborg corresponds apparently to the *Cotingidæ*, or Chatterers, of other authors. Of the *Cotingas*, there are a great many species: they are showy birds, residing in the tropical portions of America, especially on the trees that grow by the sides of the rivers. They feed on fruits and insects, and are thus compelled to migrate from place to place in search of their food. The female deposits four eggs, and the nest is found in the highest branches of trees.

Nearly allied to, if not included in this group, are the species of *Procnias* (Bell Birds). These birds reside in the tropical forests of America; in habits they resemble the *Cotinga*, and some species "possess a very loud and powerful voice, which may be heard a great distance, and is said to vary according to the season. It is stated that the noise uttered by one of these birds is like the tolling of a distant church bell, which is more distinctly heard during the heat of the day, when every other bird has ceased to sing. This bird utters a toll, and a minute pause ensues; then another toll, with a repetition of the pause, and then again a toll, and so on: the note of another species has been compared to the noise produced by striking a hammer on an anvil."

Of the *Psarinae*, or Beards, Gray gives the following account, when treating of the genus *Tityra*:—

"The birds that compose this genus are found in the warmer parts of South America and the islands of the West Indies. They migrate from place to place, and are usually seen perched on the highest branches of the lofty trees of the primeval forests. Insects form their chief subsistence; these they capture by short flights, and return again to the same perch to watch for others passing within a certain range.





Lantanas. Local name

Phoenicopterus ruber
Red Flamingo



Tringa Pugnax
Ruddy Turnstone

Charadrius Limicola
Long-billed Plover

Platalea Alba
Great Egret

FAMILY ANABATIDÆ. TREE CREEPERS AND ANABATES.

This group is divided into two sub-families.

ANABATIDÆ. { nearly equal to the middle
Outer toe { shorter than the middle. Hallux longer than in the preceding *DENDROCOLAPTINÆ.*

Of the *Anabatinae*, the habits of *Anabates*, as given by Gray, will furnish the example.

"It is in the warmer parts of South America that these birds reside in bushy places on the sides of the rivers. They are sedentary, generally in small flocks of ten or twelve, dispersed in the neighboring shrubs, on which they are constantly on the move, sometimes leaping from branch to branch, or hopping about on the ground round the stems of the thorny shrubs, which they seem to prefer to other kinds: these they search for minute insects and seeds. When perched, they erect their crests, and at the same time utter loudly, without interruption, a varied note."

Of the *Dendrocolaptinæ*, or Tree Creepers, the habits of the typical genus *Dendrocolaptes* will illustrate the group. These birds inhabit the vast forests of the warmer parts of South America. They are usually observed clinging to the trunks and branches of trees by means of their strong, curved claws and the rigid points of their tail feathers, examining the cracks of the bark and among the foliage for the larvae of insects, and even those in a perfect state, on which they principally subsist. In fact, in their habits and manners they closely assimilate to the Common Creeper. The female deposits from three to four eggs in hollow trunks of trees.

Mr. Vigors says, "The whole of the birds, however, thus united by close affinities, and as such generally brought together by systematic writers into one conterminous series, are decidedly divisible into two distinct groups, naturally arranging themselves under different subdivisions of the order. The family of *Certhiadæ* live upon animal food, while the remaining genera of the Linnaean *Certhia* subsist chiefly upon vegetable juices. The tongues of each, though similar, in being more or less extensible, and in being the medium through which they are supplied with food, are equally distinct as the nature of the food itself. Those of the former are sharp, and of a spear-like form, as if to transfix the insects which are their prey, while those of the latter are divided into tubular filaments, which appear exclusively adapted to the purposes of suction. In other particulars they exhibit an equal difference. The *Certhiadæ* climb, and their feet are of a conformable structure; but the feet of suctorial birds are not only in general unsuited to that purpose, but they become gradually weaker as they come nearer the type of the tribe, where they are so short and slightly formed as to be serviceable only in perching, when the bird is at rest."

ORDER ZYGODACTYLI. CLIMBERS.

THE *Zygodactyli* of Lilljeborg correspond very generally with the Order Seansores of other authors.

This group is divided, by the present arrangement, into eight families and nineteen sub-families, which are characterized as follows:—

Z Y G O D A C T Y L I.

MUSKY BIRDS	{ versatile.....	81. <i>Colinus</i> , Bonap.
TROCHILIDÆ	{ not versatile.....	82. <i>Musog laguna</i> , Swains.
GEMMÆ		83. <i>Pteromontes</i> , Bonap.
LORAKEETS	{ as long as or longer than one.....	84. <i>Glaucis</i> , Bonap.
RAMPHASTIDÆ	{ not in a basal fossa or aperture, more or maxillary. Bill long and stout.....	85. <i>Lucasianus</i> , Bonap.
CUCULIDÆ	{ in a basal fossa or aperture, and more or less covered by a membrane or shield.....	86. <i>Capitaneus</i> , Bonap.
Nostrils	{ Bill.....	87. <i>Ramphastus</i> , Bonap.
	{ Tail.....	88. <i>Thamnophilus</i> , G. Gray.
PIKEB.	Tail feathers { soft, with the tip rounded.....	89. <i>Sauvotherus</i> , Bonap.
	{ frayed, with the tip more or less acute.....	90. <i>Cuculus</i> , Bonap.
Tarsus	{ not longer than the inner toe without its nail. Eyes.....	91. <i>Indicatorm</i> , Swains.
	{ not surrounded by skin.....	92. <i>Jamaicensis</i> , Bonap.
	{ and area. Tongue { broad, depressed.....	93. <i>Pteropus</i> , Swains.
	{ and fleshy.....	94. <i>Nicobaricus</i> , Bonap.
	{ Tail.....	95. <i>Heterosaurus</i> , Bonap.
	{ or even.....	96. <i>Psittacus</i> , Hager.
	{ or less.....	97. <i>Ara</i> , G. Gray.
	{ longer than the inner anterior toe without its nail. Claws.....	98. <i>Phaethornis</i> , Swains.
	{ short and strongly incurved.....	99. <i>Pezoporus</i> , Bonap.

Of course our limits will not permit a review of these sub-families in their habits and peculiarities, and we can direct our attention only to the leading groups.

FAMILY PSITTACIDÆ. PARROTS, MACAWS, PARRAKEETS, LORIES.

Mr. Vigors declares it as his opinion that the *Psittacide* afford more difficulties to the inquirer into affinities than any other group in the known class; he remarks that, in manners and general structure, as well as in the mode of using their feet and bill, the Parrots hold nearly an insulated situation among birds, and that they may, perhaps, be pronounced to be the only group among them which is completely *sui generis*. Yet, because the Parrots and the Woodpeckers are climbers, *par excellence*,—differing, however, as he states, as to the mode in which they climb,—he associates them together, and considers the Barbets (*Pogonias*) to be the link of union between them.

Mr. Swainson is of opinion that the Parrots constitute the sub-typical division of the Seansores, in which the powers of climbing are less developed. "If," says that writer, "any group in nature be isolated, it is this. Possessing in themselves the strongest characteristics, there is no bird yet discovered which presents any point of connection to them; approximations are certainly made by the Tooth-billed Barbets, but still there is a gap which no genus discovered is calculated to fill up." In the Parrot tribe the

modification of the bill is very remarkable. In many birds the upper mandible is more or less movable at its junction with the forehead. In the Parrots, this mobility is carried out to its fullest extent, a sort of hinge uniting the upper mandible to the forehead, while the slender bones, connecting the upper mandible to the base of the skull, yield to every movement.

Across the horny palate of the beak is a sort of notch, against which the front margin of the lower beak works; and this margin, chisel-like, is sharp and thin, while the articulation of the lower mandible is as loose as possible. Hence, aided by the thick, fleshy tongue, a Parrot, as we have often seen, will, by means of its beak, clear the inside of a fresh pea from the outer skin, rejecting the latter, and perform the whole process, not only with facility, but with the greatest delicacy of manipulation, if this term is allowable. In all birds, as a rule, the margin of the orbit is incomplete. In the Parrot, the bony ring, varying in breadth, is complete, and below it runs the slender bone connecting the upper mandible with the *os quadratum*. "The lower mandible is light, thin, and deep. The tongue is thick, muscular, and in constant requisition: it is covered with papillæ, is moistened with saliva, and possesses both taste and great mobility. In the Lorikets (*Trichoglossus*), however, which feed on the nectar of the flowers of the *Eucalypti*, in Australia, it is furnished with a brush of delicate, close-set filaments."

The Parrots are a noisy race, associating together in flocks, and feeding upon fruits, buds, seeds, &c.: they sleep crowded together, and are fond of pruning each other's plumage: they are monogamous, the pairs forming lasting associations, and they breed in the hollows of trees. With respect to powers of flight, they vary considerable; some fly slowly, but others wing their way with the greatest rapidity, and for a long continuance. It is to the warmer climates, more particularly, that these birds are confined; and they are abundant in the inter-tropics. In the southern hemisphere, however, they occur in temperate latitudes, while in the northern hemisphere, they are rare beyond the Tropic of Cancer; the Carolina Parrot, in America, and some of the genus *Poicephalus*, in India, however, are extra-tropical. On the contrary, Parrots occur in the southern extremity of America, throughout New Holland, Van Diemen's Land, New Zealand, and even in Macquarie Island, in the fifty-second degree of south latitude.

Of all birds, Parrots are the most susceptible of being rendered tame and familiar; and towards their protectors they often manifest great attachment, courting their notice and caresses. They are decidedly the most intelligent of the feathered race, and are quick in learning to repeat words, sentences, and tunes: they mimic the voices of other animals,—the barking of dogs,

the mewing of cats, and the crowing of poultry,—and their memory is retentive, and their ear is accurate. Individuals, however, differ in their qualifications, and some species are superior to others in the facility with which they learn their lessons, the Gray Parrot of Africa (*Psittacus erythacus*) being preëminent.

In the classical writings of antiquity we have several references to these birds, which appear to have been great favorites and in general request. Aristotle well described their tongue as resembling that of man, whence, as he conjectured, arose the facility with which they pronounce words or sentences. The Greeks were the first of European nations who became acquainted with birds of the Parrot tribe, viz., some of the species of the Indian genus *Pulicornis* (Parrakeets); these, from all accounts, were introduced into Europe from India at the time of the Macedonian conquest, and, having been once brought into Greece, the great demand for them, and the high prices for which they sold, rendered the importation of them a profitable speculation.

From Greece the Parrot soon found its way to Rome, and became extravagantly admired. It was kept in cages of the most costly materials, nor was any price, however inordinate, deemed beyond its value. Until the time of Nero the Romans were not acquainted with the Parrots of Africa; but as that country became more known, these birds, with other natural productions, were sent to Italy; and most probably it was from that quarter that the numbers of the Parrot race were imported, which, at a subsequent period, supplied the luxury of Heliogabalus. Among other articles in the bill of fare, detailed by *Aelian* as entering into the feasts of this emperor, are the combs of fowls, the tongues of peacocks and nightingales, the brains of flamingoes and thrushes, the heads of parrots and pheasants, and it is reported that with the bodies of the two latter he fed his beasts of prey.

In captivity the Parrot lives long; instances are on record of individuals attaining the age of eighty or one hundred years.

The Macaws occur in the warm regions of South America, and are among the largest of the Parrot race. They are easily domesticated, and become very gentle and familiar, but in their powers of imitation they fall far short of the true Parrots and Parrakeets; their natural cries are harsh, discordant, and piercing, and are pronounced in a disagreeable tone. The beak is of enormous size and strength; the cheeks are, to a greater or less extent, bare; the nostrils are concealed; the under mandible is very deep. The plumage is remarkable for gaudy coloring. The Blue and Yellow Macaw is a native of Brazil, Guiana, and Surinam, tenanting the swampy forests along the banks of rivers, and generally living in pairs, though sometimes they assem-

ble in large flocks. The food of this species consists principally of a fruit of a kind of palm abundant in humid or marshy places. On the wing, the Blue and Yellow Macaw is rapid, displaying great address and ease in its aerial movements, and is often seen skimming over the tops of the loftiest trees, the highest branches of which it selects for its roosting-place. Like the Parrots generally, this Macaw lays two white eggs in the hollow of a decayed tree; both sexes attend to the duty of incubation, and to the labor of rearing the young. Two broods are said to be produced annually.

The Lorikeets (*Trichoglossi*) are natives of Australia, and are characterized by the tongue being furnished at its apex with a pencil or brush of strong hairs, rendering it an efficient agent in procuring food. This consists of the nectar of various species of *Eucalypti*, some of which are always in flower, thus furnishing the flocks with an abundant supply. Were it not for this succession of blooms the Lorikeets would be straitened for food. Among the pendent blossoms of these trees may the Lorikeets be observed clinging in every attitude, and busily engaged in absorbing, with their pencil-tufted tongues (and so licking up), the honey from the cups of the newly-expanded blossoms, which they have compressed and nibbled with their beaks. "To such an excess," says Mr. Gould, "do these birds satiate themselves with their liquid food, that, on suspending a fresh-shot specimen by the toes, a large tea-spoonful, at least, of honey will flow from the mouth;" and he adds, "when we know this to be the natural food of this group, how can it be expected that the species can exist in captivity upon the hard seed or farinaceous diet so generally given as a substitute?" And we agree with him in thinking that if honey or liquid saccharine matter were afforded them, they might be kept in cages and aviaries; and when it is considered that they are among the most elegant and beautiful of their race, it is desirable for those who have the opportunity of making a series of trials.

According to Mr. Calez, the Blue-Mountain Lorikeet, or Blue-Mountain Parrot (Warrin of the natives), is remarkable for its docility and attachment to some people, whilst it is a perfect scold to others, who may have teased or offended it. "Flocks of these birds," says this accurate observer, "may be seen in the *Eucalypti* trees when in flower, in different parts of the country, but in the greatest number near their breeding-places. It does not eat any kind of grain, even when in a domesticated state. It is much subject to fits, which generally prove fatal; and it is rare to find an individual kept alive above a couple of years. One that I kept, on being shown a figure of a colored plant, used to put its tongue to the flowers, as if with the intent of sucking them; and I have seen it make the same attempt with a piece of cotton furniture. The flesh of this bird is very good eating."

Again, speaking of the Crimson-fronted Parakeet, Coolich of the natives (*Trichoglossus concinnus*), Mr. Calez states that it may be observed in large flocks sucking the *Eucalypti* flowers. He adds, that like the Blue-Mountain Parrot, it is subject to fits, which generally prove fatal; that it is seldom kept alive, and that its breath, or some part above its head, emits a very sweet odor. The natives told him that this species breeds in the hollow boughs of trees, scraping out the decayed mould, and making its nest of it. The eggs, he informs us, are green, without spots, and the number of young two. Of the Small Parakeets (Jarryang of the natives) (*Trichoglossus pusillus*), he observes that this, like the Coolich, is seen in very large flocks in the *Eucalypti* trees when in bloom. "The natives," says he, "now and then bring in the young ones, but they seldom live long. I had three young ones for some time, which used to huddle together, and give out a very pleasing note. They all died strongly convulsed, and nearly at the same time the limbs were as stiff the moment life was extinct as if the body had become cold. The natives tell me that it builds in the hollow limbs of trees, making no other nest than of the decayed wood. The eggs are white and without spot."

In the Cockatoos the bill is strong, short, broad, with the upper mandible much curved; the head is ornamented with a folding crest; base of the under mandible frequently concealed by feathers. Wings long; tail even. Locality, Australia and the Indian Islands. These birds inhabit the woods, feeding on fruit, and breeding in hollow trees: their cry is harsh, loud, and disagreeable, but they are readily tamed, and though not celebrated for their powers of imitation, are engaging from their gentleness and affectionate disposition. Their plumage is very powdery. They live long in captivity. An authenticated instance is on record of a great Sulphur-crested Cockatoo which attained the age of one hundred and twenty years. Mr. Gould, who, in his "Birds of Australia," has given a magnificent figure of the *Cacatua galerita* of Vieillot, observes, that if we regard the White Cockatoo of Van Diemen's Land and that of New Guinea as mere varieties of each other, this species has a more extensive range than most other birds. It is an inhabitant of all the Australian colonies, both on the southern and northern coasts, but has not yet been seen on the western. "On a close examination of the specimens from the three countries above mentioned, a decided difference is observable in the structure of the bill, or rather, perhaps, a modification of the organ for the peculiar kind of food afforded by the respective countries. The Van Diemen's Land bird is the largest in every respect, and has the bill, particularly the upper mandible, less abruptly curved; the bill of the New Guinea bird is much rounder, and is, in fact, fitted to perform a totally different office from that of the White Cockatoo of Van Diemen's

Land, which, as I have ascertained by dissection, feeds principally on the small bulbs of the terrestrial *Orchidaceæ*, for procuring which its lengthened upper mandible is admirably adapted, while it is more than probable that no food of this kind is to be obtained by the New Guinea bird, the structure of whose bill indicates that hard seeds and nuts constitute the principal part of its diet. The crops and stomachs of those killed in Van Diemen's Land were very muscular, and contained seeds, grain, native bread (a species of fungus), small tuberose, and bulbous roots, and, in most instances, large stones."

As may be readily imagined, this bird is not upon favorable terms with the agriculturists, upon whose fields of newly-sown grain and ripening maize it commits the greatest devastations: it is consequently hunted down wherever it is found — a circumstance which tends much to lessen its numbers. It is still, however, very abundant, moving about in flocks, varying from a hundred to a thousand in number, and evinces a decided preference to the open plains and cleared lands, rather than to the dense brushes near the coast. "Except when feeding or reposing on the trees after a repast, the presence of a flock, if not seen, is certain to be indicated by their horrid, screaming notes, the discordance of which may be slightly conceived by those who have heard the peculiarly loud, piercing, grating scream of the bird in captivity, always remembering the immense increase of the din occasioned by the large number of the birds uttering their disagreeable notes at the same moment: still I ever considered this annoyance amply compensated for by their sprightly actions, and the life their snowy forms imparted to the dense and never-varying green of the Australian forest — a feeling participated in by Sir Thomas Mitchell, who says that amidst the umbrageous foliage, forming dense masses of shade, the White Cockatoos sported like spirits of light."

FAMILY PICIDÆ. WOODPECKERS.

These birds are generally distributed in both hemispheres. Mr. Swainson is of opinion that the structure of the Picidæ constitutes them the most perfect of all the climbing birds, for nature has rendered their whole organization subservient to this particular power. "The feet," he observes, "although short, are unusually strong; the nails are broad and crooked, and the toes placed in pairs, two forward and two backward. As an additional and powerful support, in their rapid and perpendicular ascent up the trunks of trees, their tail feathers," he remarks, "terminate in points, and are uncommonly hard, so that, being pressed against the bark, they assist the bird in its progress, or in keeping its position. The bill, destined for the laborious operation of penetrating the wood, or stripping off the bark of forest trees, is beautifully adapted for the purpose, being wedge-shaped,

furnished with regular-sided angles, and in one species (*Picus principalis*) nearly of the color and consistency of ivory, whence it has been termed the Ivory-billed Woodpecker."

Mr. Yarrel, in describing the characteristics of the Woodpeckers, says,—

"Moderate powers of flight, sufficient to transport the bird from tree to tree, are all that it seems to require: large pectoral muscles, with a deep keel to the breastbone, would, to this bird, be an inconvenience. The advantage of a narrow, shallow keel is immediately apparent, on looking at a representation of the skeleton in a climbing position; the low keel allowing the bird to place its body close to the tree, brings its centre of gravity in a perpendicular line before the points of support, and thus materially diminishes the labor of, and the strain upon, the muscles of the legs and thighs."

Of the *Picine*, or true Woodpeckers, the Ivory-billed Woodpecker is a good type. This species is a native of North America, being found in the swampy forests of the Southern and South-western States.

"Descending the Ohio," says Audubon, "we meet with this splendid bird, for the first time, near the confluence of that beautiful river and the Mississippi; after which, following the windings of the latter, either downwards towards the sea, or upwards in the direction of the Missouri, we frequently observe it. On the Atlantic coast, North Carolina may be taken as the limits of its distribution, although now and then an individual of the species may be accidentally seen in Maryland. To the westward of the Mississippi, it is found in all the dense forests bordering the streams which empty their waters into that majestic river, from the very declivities of the Rocky Mountains. The lower parts of the Carolinas, Georgia, Alabama, Louisiana, and Mississippi, are, however, the most favorite resorts of this bird; and in those States it constantly resides, breeds, and passes a life of peaceful enjoyment, finding a profusion of food in all the deep, dark, and gloomy swamps dispersed throughout them."

Beetles, larvae, and large grubs constitute the chief diet of this species; and for these it attacks the bark and wood of decayed trees, its strokes resounding far through the gloomy wilds. "Wherever he frequents," says Wilson, "he leaves numerous monuments of his industry behind him. We there see enormous pine trees, with cart-loads of bark lying around their roots, and chips of the trunk itself in such quantities as to suggest the idea that half a dozen axe-men had been at work there for the whole morning. The body of the tree is also disfigured with such numerous and so large excavations that he can hardly conceive it possible for the whole to be the work of a Woodpecker."

Audubon says he has seen it detach pieces of bark seven or eight inches

POTELRY

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BLACK GAME

PARTHIDGE COCH



COLORED DORKIN

GOLDEN SPANGLED POLISH



TURKEY



PEACOCK



in length at a single blow, busy in quest of insects, all the while sounding its loud notes, as if highly delighted. Sound and healthy trees, however, are never thus attacked, excepting for the purpose of nidification. The tree selected, for this purpose, is either an ash or a hagberry; and at a great elevation, the pair, relieving each other by turns, begin their operations. They generally select a spot under the junction of a large branch, with the trunk as a defence against rain. They first excavate horizontally for a few inches, and then downwards, the extent of the cavity varying from a foot to three feet downwards, into the core of the tree; the diameter is about seven inches, but the aperture will only just admit the bird. The eggs, generally six, are white. Two broods are usually reared each summer. Besides insects, this Woodpecker devours wild grapes, persimmons, and hagberries. The flight of this species is very graceful, though, as Audubon says, seldom prolonged to more than a few hundred yards at a time, unless when it has to cross a large river, which it does in deep undulations, but the transit from tree to tree is performed by a single sweep. It seldom utters any sound while on the wing; but as soon as it alights, its voice is heard, the notes resounding to a considerable distance, and may be represented by the monosyllable *pait, pait, pait*, in tone like the false high note of a clarionet.

The head and bill of this species are held in great esteem, as a sort of charm or amulet, by many of the tribes of America, who ornament their belts with them; and Europeans purchase them as beautiful curiosities. When wounded, this bird generally ascends the nearest tree, in a spiral direction, till it attains the top branches, where it hides; but if intercepted and laid hold of, it defends itself both with its beak and claws, inflicting severe lacerations.

The Pileated Woodpecker (*Hylatomus pileatus*) is also well known. It is found only in American forests, and is recognized by a number of names, — such as Log Cock, Black Wood-Cock, Great Woodpecker, &c. Its color is black, with a streak of white across the head and on the sides of the breast, and the crown is of a scarlet red.

The great size and strength of this bird enable it to pierce into and tear apart the decaying trees in which its food is burrowing, with wonderful facility and ease. We have, at times, in passing through the forest, found huge trees that had died and fallen to the ground, with their bark stripped off, and large chips torn out, as if some animal had been at work on them; and we always supposed that a bear had been amusing himself, as those animals sometimes do, in this employment. One day we discovered the author of the demolition, and it proved to be the Pileated Woodpecker. While seated in the woods near the settlement known as Wilson's Mills, in Maine, we heard a large animal, as we supposed, rooting and tearing into a dead tree a

few rods off. We crept up near the sound, hoping to get a shot at a bear, when we discovered this bird, which looked very much like a black hen, busily at work. He was searching for the borers and large black ants that hide beneath the bark; and so earnestly was he employed, that he permitted us to approach very near him. He would force his powerful bill, by repeated strokes, into the bark, in holes in a direct line with the grain, until he had marked out a patch, perhaps six or eight inches square, and then, striking into it diagonally, tear it off, thus exposing the living vermin beneath, which he lost no time in securing. After clearing that spot, he moved to another, and repeated the same operation, until, by a sudden movement, we startled him, when he flew off, uttering a rattling cackle similar to that of a garrulous hen. His flight was similar to that of the other Woodpeckers described in another place in this volume. In addition to insects, this Woodpecker eats acorns, beech-nuts, berries, and Indian corn, but is not at all troublesome to farmers; and the little that it pilfers is much more than repaid by the immense numbers of injurious larvæ that it destroys.

The Downy Woodpecker is also well known.

This little Woodpecker—the smallest we have—is abundantly distributed throughout the Eastern United States, and is a resident throughout the year. The exceedingly interesting description of its habits, by Wilson, is so full that we will give it entire. He says,—

"About the middle of May the male and female look out for a suitable place for the reception of their eggs and young. An apple, pear, or cherry tree—often in the near neighborhood of the farm-house—is generally fixed upon for this purpose. The tree is minutely reconnoitred for several days previous to the operation; and the work is first begun by the male, who cuts out a hole in the solid wood as circular as if described with a pair of compasses. He is occasionally relieved by the female, both parties working with the most indefatigable diligence. The direction of the hole, if made in the body of the tree, is generally downwards, by an angle of thirty or forty degrees, for the distance of six or eight inches, then straight down for ten or twelve more: within, roomy, spacious, and as smooth as if polished by the cabinet-maker; but the entrance is judiciously left just so large as to admit the bodies of the owners. During this labor, they regularly carry out the chips, often strewing them at a distance, to prevent suspicion. This operation sometimes occupies the chief part of a week. Before she begins to lay, the female often visits the place, passes out and in, examines every part—both of the exterior and interior—with great attention (as every prudent tenant of a new house ought to do), and at length takes complete possession. The eggs are generally six,—pure white, and laid on the smooth bottom of the cavity. The male occasionally supplies the female

with food while she is sitting; and, about the last week in June, the young are perceived making their way up the tree, climbing with considerable dexterity. All this goes on with great regularity where no interruption is met with; but the House Wren, who also builds in the hollow of a tree, but who is neither furnished with the necessary tools, nor strength for excavating such an apartment for himself, allows the Woodpeckers to go on till he thinks it will answer his purpose, then attacks them with violence, and generally succeeds in driving them off. I saw, some weeks ago, a striking example of this, where the Woodpeckers we are now describing, after commencing in a cherry tree, within a few yards of the house, and, having made considerable progress, were turned out by the Wren. The former began again on a pear tree in the garden, fifteen or twenty yards off, whence, after digging out a most complete apartment, and one egg being laid, they were once more assaulted by the same impudent intruder, and finally forced to abandon the place.

"The principal characteristics of this little bird are diligence, familiarity, perseverance, and a strength and energy in the head and muscles of the neck which are truly astonishing. Mounted on the infected branch of an old apple tree, where insects have lodged their corroding and destructive brood, in crevices between the bark and wood, he labors sometimes for half an hour incessantly at the same spot, before he has succeeded in dislodging and destroying them. At these times, you may walk up pretty close to the tree, and even stand immediately below it, within five or six feet of the bird, without in the least embarrassing him. The strokes of his bill are distinctly heard several hundred yards off; and I have known him to be at work for two hours together on the same tree. Buffon calls this 'incessant toil and slavery;' their attitude, 'a painful posture;' and their life, 'a dull and insipid existence,'—expressions improper because untrue, and absurd because contradictory. The posture is that for which the whole organization is particularly adapted; and though to a Wren or Humming Bird the labor would be both toil and slavery, yet to him it is, I am convinced, as pleasant and as amusing as the sports of the chase to the hunter, or the sucking of flowers to the Humming Bird. The eagerness with which he traverses the upper and lower sides of the branches, the cheerfulness of his motions while digging into the tree and dislodging the vermin, justify this belief. He has a single note or *chink*, which, like the former species, he frequently repeats; and when he flies off, or alights on another tree, he utters a rather shriller cry, composed of nearly the same kind of note, quickly reiterated. In fall and winter he associates with the Titmouse, Creeper, &c., both in their wood and orchard excursions, and usually leads the van. Of all our Woodpeckers, none rid the apple trees of so many vermin as this, digging off the moss which the negligence of the proprietor had suf-

ferred to accumulate, and probing every crevice. In fact, the orchard is his favorite resort in all seasons, and his industry is unequalled and almost incessant, which is more than can be said of any other species we have. In the fall, he is particularly fond of boring the apple trees for insects, digging a circular hole through the bark, just sufficient to admit his bill; after that, a second, third, &c., in pretty regular horizontal circles round the body of the tree: these parallel circles of holes are often not more than an inch or an inch and a half apart, and sometimes so close together that I have covered eight or ten of them at once with a dollar. From nearly the surface of the ground up to the first fork, and sometimes far beyond it, the whole bark of many apple trees is perforated in this manner, so as to appear as if made by successive discharges of buckshot; and our little Woodpecker—the subject of the present account—is the principal perpetrator of this supposed mischief: I say supposed, for, so far from these perforations of the bark being ruinous, they are not only harmless, but, I have good reason to believe, really beneficial to the health and fertility of the tree. I leave it to the philosophical botanist to account for this; but the fact I am confident of. In more than fifty orchards, which I have myself carefully examined, those trees which were marked by the Woodpecker (for some trees they never touch, perhaps because not penetrated by insects) were uniformly the most thriving, and seemingly the most productive. Many of these were upwards of sixty years old, their trunks completely covered with holes, while the branches were broad, luxuriant, and loaded with fruit. Of decayed trees, more than three fourths were untouched by the Woodpecker. Several intelligent farmers, with whom I have conversed, candidly acknowledge the truth of these observations, and with justice look upon these birds as beneficial; but the most common opinion is, that they bore the tree to suck the sap, and so destroy its vegetation: though pine and other resinous trees, on the juices of which it is not pretended they feed, are often found equally perforated. Were the sap of the tree their object, the saccharine juice of the bireh, the sugar-maple, and several others, would be much more inviting (because more sweet and nourishing) than that of either the pear or apple tree; but I have not observed one mark on the former for ten thousand that may be seen on the latter. Besides, the early part of spring is the season when the sap flows most abundantly; whereas, it is only during the months of September, October, and November that Woodpeckers are seen so indefatigably engaged in orchards, probing every crack and crevice, boring through the bark—and, what is worth remarking, chiefly on the south and south-west sides of the tree—for the eggs and larvæ deposited there by the countless swarms of summer insects. These, if suffered to remain, would prey upon the very vitals—if I may so express it—of the tree, and, in the succeeding summer, give birth to myriads more of their race, equally destructive.

"Here, then, is a whole species, I may say genus, of birds, which Providence seems to have formed for the protection of our fruit and forest trees from the ravages of vermin, which every day destroys millions of those noxious insects that would otherwise blast the hopes of the husbandman; they even promote the fertility of the tree, and, in return, are proscribed by those who ought to have been their protectors, and incitements and rewards held out for their destruction! Let us examine better into the operations of nature, and many of our mistaken opinions and groundless prejudices will be abandoned for more just, enlarged, and humane modes of thinking."

FAMILY CUCULIDÆ. CUCKOOS.

Mr. Swainson remarks of the *Cuculidæ*, —

"So faintly is the scansorial structure indicated in these birds, that but for their natural habits, joined to the position of their toes, we should not suspect they were so intimately connected with the more typical groups of the tribe, as they undoubtedly are. They neither use their bill for climbing, like the Parrots, nor for making holes in trees, like the Woodpecker; neither can they mount the perpendicular stems, like the *Certhiæ*, or Creepers; and yet they decidedly climb, although in a manner peculiar to themselves. Their flight is so feeble, from the extreme shortness of their wings, that it is evidently performed with difficulty, and it is never exercised but to convey them from one tree to another, and these flights, in the thickly-wooded tracts of tropical America, are, of course, very short: they alight upon the highest boughs, and immediately begin to explore the horizontal and slanting ramifications with the greatest assiduity, threading the most tangled mazes, and leaving none unexamined. All soft insects inhabiting such situations lying in their route become their prey, and the quantities that are thus destroyed must be very great. In passing from one bough to another, they simply hop, without using their wings, and their motions are so quick, that an unpractised observer, even if placed immediately beneath the tree, would soon lose sight of the bird.

"Warm and temperate climates of both hemispheres are the chosen haunts of the Cuckoos. The species peculiar to North America build their nests, and rear their own young, while most of the others are parasitic."

Of one species, the Black-billed Cuckoo (*Coccygus erythrophthalmus*) is probably the best known. It is found in most portions of the Eastern United States, and is in many localities common. In New England, it arrives from the south about the first week in May, and, like the Yellow-billed Cuckoo, the males precede the females. We have examined numbers of the first birds that arrived in different seasons, and they were invariably males, the females making their appearance about ten days or a fortnight later. The

habits of the two species are very similar, although the present bird prefers the more cultivated and open districts, while the other seems to delight in the more retired and wooded localities.

In flight, the Black-billed Cuckoo is more swift than the other; in breeding habits, the same; and its food is similar, consisting principally of insects and their larvæ, small fruits, and the eggs and young of small birds. Like the other, the Black-billed Cuckoo is very cowardly, and is quickly driven from the neighborhood of the nest of almost any of the other birds. If a robin, or other bird of equal size, discover one of these, to him pirates, in the vicinity of his nest, he immediately assaults the intruder, with loud outcries, pouncing upon him, and pecking with great ferocity. Others of his neighbors, who are near, join in the attack: the Cuckoo, in retreating, dives into the recesses of a stone wall, or the first secure retreat available, very seldom taking to his wings, as another bird would do. We have known of a Cuckoo being driven into a barn by a bluebird (*S. sialis*), who sat perching on a fence outside for several minutes, keeping his enemy prisoner; and the latter, when pursued and captured, preferred being our prisoner to facing his enemy outside.

The nest of the Black-billed Cuckoo is usually placed in a low tree or barberry-bush. It is constructed of twigs, roots, and sometimes a few leaves and moss. We have examined a great number of these, from different sections, and have noticed that those from northern localities were invariably lined with gray moss, called Spanish moss, and leaves, while others, from more southern districts, were without such linings.

The eggs are usually four in number: they are of a darker greenish blue than those of the other bird, and average a little smaller, their length varying from 1 to 1.12 inch, by from .84 to .92 inch in breadth.

Of the *Cuculinae*, or Cuckoos, the Common Cuckoo (*Cuculus canorus*) of Europe is a good example.

The following account of this species is by Gilbert White:—

"In July I saw several Cuckoos skimming over a large pond, and found, after some observation, that they were feeding on *Libellulae*, or dragonflies, some of which they caught as they settled on the weeds, and some as they were on the wing. The favorite food of this bird, however, are the hairy caterpillars, or some of the lepidopterous order; these it kills by passing them through the sharp edges of its mandibles; it then nips off the hinder end of the caterpillar, and, with a jerk or two, clears the body of the alimentary canal, and immediately swallows it whole. With the hairs of the caterpillar the stomach is often completely coated. In a communication by Mr. Thompson to the Zoölogical Society in 1834, he states, that in three Cuckoos, examined in 1833, the stomach, with the exception of some small, sharp gravel, was entirely empty, and coated closely over with hair.

"Attention was called to this, that the hair with which it is lined might be observed. From its close adhesion to the inner surface of the stomach, and from the regularity with which it is arranged, Mr. Thompson was at first disposed to consider this hair as of spontaneous growth; but part of the stomach being subjected to maceration in water, and afterwards viewed through a microscope of high power, the hairs proved, to the entire satisfaction of Mr. Owen and himself, to be altogether borrowed from the larvæ of the tiger-moth (*Arctia caja*), the only species found in the stomachs of several Cuckoos, from different parts of the north of Ireland, which were examined by Mr. Thompson, in the months of May and June, 1833, and whose stomachs were similarly coated." (Proceedings Zoöl. Soc., 1839, p. 29.)

The well-known notes of the Cuckoo are confined to the male, the female making only a chattering noise.

The singular habit of the Cuckoo, in depositing its eggs in the nests of other birds, is too well substantiated to admit of a doubt; the nests usually chosen are those of the Hedge Sparrow, Titlark, White Throat, Wagtail, &c. The egg is very small in comparison with the size of the Cuckoo, scarcely exceeding that of a common Chaffinch. When the young Cuckoo is hatched, and has acquired a little strength, guided by the instinct of self-preservation it dislodges all its weaker companions by insinuating itself under them, and, with a sort of jerk, forces them overboard. Thus it secures to itself the exclusive attention of its dupes of foster-parents. Gilbert White mentions a young Cuckoo found in the nest of a Titlark, which he describes as being very fierce and pugnacious, pursuing his finger, as he teased it, for many feet from the nest, and sparring and buffeting with its wings like a game-cock; and Selby alludes to the same bold and pugnacious disposition.

Many attempts have been made to keep the Cuckoo alive in captivity, and several have lived, with care, to the middle of winter, when they have died. Mr. Thompson, however, instances two exceptions; one of these lived for more than a year at Crummore, near Belfast, the residence of John Templeton, Esq.: it was procured on the 26th of July, 1820, and died, in consequence of an accident, January 10, 1822. It was originally taken from a Titlark's nest. "Its engaging manners," says Mr. Templeton, "were the delight of the whole family and admiration of strangers. It was generally fed on hard-boiled eggs, and occasionally on caterpillars: it would sometimes eat forty or fifty at a time of the *Papilio Brassicide*; it, however, showed a decided preference for rough ones, as those of the *Papilio Urtice*. A seeming treat was a little mouse, about one quarter grown, which it would hold in its bill and beat against the ground, or anything hard, until the animal became soft, when it exhibited great powers of extending

its throat and swallowing. What, however, was most extraordinary, it was never known to drink, though, when presented with a drop of water, at the end of a finger or straw, it would sip it, and it seemed to delight, when seated on its mistress's or other person's hand, to put its bill into their mouths and sip saliva. It delighted very much in heat, and sitting in the sunshine; and its feathers were so much broken by striking them against the furniture, that it could fly but very imperfectly, and apparently very thankful to any person who would help it upon the first sash of the window. At other times it sat upon the fender, turning itself in various directions, and spreading its wings and feathers to receive the heat, of which it could bear a temperature equal to one hundred degrees, for a considerable time, with seeming satisfaction. During cold weather it slept at its mistress's bedside, covered with a piece of flannel, which was well warmed, previous to its going to rest. With this attention, it generally remained quiescent till morning; but, on feeling cold, sometimes presumed so far as to creep under the bed-clothes.

"It was only to those from whom it had received some hurt or persecution that it expressed dislike or fear, which it did by raising its neck feathers and putting itself in an attitude of defence. It never uttered the cry of the male, —cuckoo,—but sometimes, when persons were in the room laughing, it would apparently join, and emit a noise somewhat like the barking of a little dog. At other times, the only sound it made was a kind of low-chattering expression of pleasure when it got into a warm place, or on seeing its mistress after she had been absent some hours. It received the unlucky tramp, which finally killed it, from having lost too much the apprehension of injury."

(Ann. and Mag. of Nat. Hist., 1842, p. 223.)

FAMILY RHAMPHASTIDÆ. TOUCANS.

The *Rhamphastidæ* are all natives of tropical America, where they live retired in the deep forests, mostly in small companies. Their flight is straight but laborious, and while on the wing the beak is raised and directed forwards, so as to offer as little resistance as possible to the air. Among the branches of the trees their movements are easy and active; they appear to glide from branch to branch, and in this manner ascend to the very summits. D'Azara states that the Toucans are, to a certain extent, omnivorous, living a great part of the year on fruits, but during the breeding season attacking the smaller birds in their nests, and devouring their eggs or their young. Even the eggs and young of the Macaws, and other large birds, often fall victims to their carnivorous propensities.

Mr. Swainson, who had seen the Toucans in their native forests, was led to suspect the same fact, and informed Mr. Broderip that he had frequently

observed them perched on the tops of lofty trees, evidently watching the departure of birds from their nests, besides which, the remains of food found in the stomachs of such as were shot, proved that eggs and young birds, as well as fruit, constituted their diet. He never, however, observed them in the act of destruction.

On the 23d of November, 1824, Mr. Vigors had spoken at the Zoölogical Club of a living Toucan, which was then exhibited in St. Martin's Lane. Mr. Vigors stated that the bird had been fed on a vegetable diet, but that the proprietor had told him, that on the occasion of a young Canary Bird having escaped and gone near to the Toucan, the latter appeared more than usually excited; that thereupon the barrier between them was removed, and that the Toucan instantly seized and devoured the Canary Bird. On the next day Mr. Broderip went to the place where the Toucan was exhibited, and thus describes what he saw:—

"After looking at the bird, which was the object of my visit, and which was apparently in the highest state of health, I asked the proprietor to bring up a little bird, that I might see how the Toucan would be affected by its appearance. He soon returned, bringing with him a Goldfinch—a last year's bird. The instant he introduced his hand, with the Goldfinch, into the cage of the Toucan, the latter, which was on a perch, snatched it with his bill. The poor little bird had only time to utter a short, weak cry, for, within a second, it was dead, killed by compression on the sternum and abdomen, and that so powerful, that the bowels were protruded after a very few squeezes of the Toucan's bill. As soon as the Goldfinch was dead, the Toucan hopped with it, still in his bill, to another perch, and, placing it with his bill between his right foot and the perch, began to strip off the feathers with his bill. When he had plucked away most of them, he broke the bones of the wings and legs (still holding the little bird in the same position) with his bill, taking the limbs therein, and giving, at the same time, a strong, lateral wrench. He continued this work with great dexterity, till he had almost reduced the bird to a shapeless mass; and ever and anon he would take his prey from the perch in his bill, and hop from perch to perch, making, at the same time, a peculiar, hollow, chattering noise; at which times I observed that his bill and wings were affected with a vibratory or shivering motion, though the latter were not expanded. He would then return the bird to the perch with his bill, and set his foot on it. He first ate the viscera, and continued pulling off and swallowing piece after piece, till the head, neck, and part of the back of the sternum, with their soft parts, were alone left; these, after a little more wrenching, while they were held on the perch and masticated, as it were, while they were held in the bill, he at last swallowed, not even leaving the beak or legs of his prey.

The last part gave him the most trouble ; but it was clear that he felt great enjoyment ; for whenever he raised his prey from the perch, he appeared to exult, now masticating the morsel with his toothed bill, and applying his tongue to it ; now attempting to gorge it, and now making the peculiar, chattering noise, accompanied by the shivering motion above mentioned. The whole operation, from the time of seizing his prey to that of devouring the last morsel, lasted about a quarter of an hour. He then cleansed his bill from the feathers by rubbing it against the perches and bars of his cage. While on this part of the subject, it may be as well to mention another fact, which appears to me not unworthy of notice. I have more than once seen him return his food after he had taken it to his crop, and, after masticating the morsel a while in his bill, again swallow it, the whole operation, particularly the return of the food to the bill, bearing a strong resemblance to the analogous action in ruminating animals. The food, on which I saw him so employed, was a piece of beef, which had evidently been macerated some time in the crop. While masticating it, he made the same hollow, chattering noise as he made over the remains of the Goldfinch. Previous to this operation, he had examined his feeding-trough, in which there was nothing but bread, which I saw him take up and reject ; and it appeared to me that he was thus reduced from necessity to the above mode of solacing his palate with animal food. His food consists of bread, boiled vegetables, eggs, and flesh, to which a little bird is now added about every second or third day. He shows a decided preference for animal food, picking out all morsels of that description, and not resorting to the vegetable diet till all the former is exhausted."

FAMILY BUCCONIDE. BARBETS.

These birds are distinguished at once by their large, conical beak, which appears swollen, as it were, or puffed out at the sides of its base, and is bearded (whence its name) with fine tufts of stiff bristles directed forwards. Their short wings and heavy proportions do not admit of swift flight ; and their prey consists of insects and young birds, which they surprise ; they also eat varieties of fruits. Their nests are generally built in the holes of trees. The two sub-families, *Bucconine* and *Cupotonine*, are founded on the genera *Bucco* (Cuvier), and *Cupito* (Vieillot). They are found in both the Old and New Worlds.

Swainson says of the Barbets,—

"There is something very grotesque in the appearance of all the Puff birds, and their habits, in a state of nature, are no less singular. They frequent open cultivated spots near habitations, always perching on the withered branches of a low tree, where they will sit nearly motionless for hours, unless, indeed, they descry some luckless insect passing near them, at

which they immediately dart, returning again to the identical twig they had just left, and which they will sometimes frequent for months. At such times, the disproportionate size of the head is rendered more conspicuous by the bird raising its feathers so as to appear not unlike a puff-ball; hence the general name they have received from the English residents in Brazil. When frightened, this form is suddenly changed by the feathers lying quite flat. They are very confiding, and will often take their station within a few yards of the window.

FAMILY GALBULIDÆ. JACAMARS.

The characteristics of the genus *Galbula* (Mechr), as given by Gray, will serve as a type of the family.

The species that compose this genus are peculiar to the tropical portions of South America, and are also found in some of the West India Isles. They inhabit the humid forests, where it is usual to observe them seated singly on some low, naked branch, until the approach of an insect calls them into action; after which they dart off rapidly, and, securing it with their lengthened, acute bill, return to the same place again. The ground around their chosen position is generally strewed with the wings of insects, as they only feed on the bodies. Some species are stated to frequent the borders of rivers and brooks, and to feed on fish and their fry. These birds form a hole in trees, or in banks of rivers, like the Kingfishers, the entrance of which is an inch and a half in diameter, and the eggs are placed about eight inches from the outward surface. They are usually three in number.

FAMILY TROGONIDÆ. TROGONS.

Mr. Gould's "Monograph of the *Trogonidæ*" gives much valuable information regarding these magnificent birds. "Greatly insectivorous," says Mr. Gould, "they seize the fluttering insect on the wing, which their wide gape enables them to do with facility, while their feeble tarsi and feet are such as to qualify them merely for resting on the branches, as a post of observation, whence to mark their prey as it passes, and to which, having given chase, to return. If not strictly elegant in form, the Trogons, in the brilliancy of their plumage, are surpassed only by the *Trochilidæ*; their splendor amply compensates for every other defect. Denizens of the intertropical regions of the Old and New World, they shroud their glories in the deep and gloomy recesses of the forest, avoiding the light of day and the observation of man. Dazzled by the brightness of the meridional sun, morning and evening twilight is the season of their activity."

Another writer describes them as being solitary birds, extremely jealous

of their freedom, never frequenting inhabited or open tracts, and delighting in the silence of deserts. The interior of the thickest forests is their chosen abode for the entire year. They are sometimes seen on the summit of trees, but, in general, they prefer the centre, where they remain a portion of the day, without descending to the ground, or even to the lower branches. Here they lie in ambush for the insects which pass within reach, and seize them with address and dexterity. Though they thus conceal themselves in the thick foliage, it is not through distrust; for when they are in an open space, they may be approached so nearly as to be struck with a stick. They are rarely heard to utter any cries, except during the season of reproduction, and then their voice is strong, sonorous, and melancholy. They have many cries, from the sound of one of which their name is derived.

FAMILY MUSOPHAGIDÆ. PLANTAIN-EATERS AND COLIES.

"The species of *Colius* are peculiar to the continent of Africa, where they are usually observed in parties on the trees, among the branches of which they are seen quickly hopping, from one to another, in search of the fruits and freshly-formed buds, on which they subsist. Their flight consists of little more than flitting from one tree to another, and they have a peculiar habit of suspending themselves by one foot attached to the branch, with the head hanging downwards. They are rarely observed on the ground, as the formation of their foot does not admit of their walking with ease. They form their nests in society, closely packed together on the same tree or bush, and composed of flexible twigs lined with feathers, the female depositing from four to six eggs."

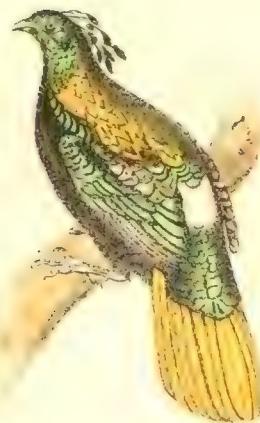
The *Musophaginæ*, or Plantain Eaters, are found in Africa. They are comprehended in several genera. Among them are the Touracos, which are very elegant birds. They feed upon soft fruits, principally the plantains. Their flight is of limited strength.

The characteristics of the foregoing families in the *Zygodactyli*, as given by Lilljeborg, are as follows:—

ZYGODACTYL. External or fourth toe	versatile forwards not versatile Second toe	directed backwards directed forwards, Bill...	without cere, Tongue	not extensible Anterior toes ...	united as far as the outer end of the second phalanx, not united to the outer end of the second phalanx, but only	to the outer end of the first phalanx, near base. Bristles, none	Bristles absent..... very large, generally twice, or more than twice as long as head. Nostrils in the dorsal surface of bill, and not surrounded by skin. Bristles present.....	42. MUSOPHAGIDÆ, Sund.
								43. TROGONIDÆ, Sund.
LUMBRICIFORM provided with a cere. The upper mandible hooked	lumbriciform and extensible							44. GALBURIDÆ, Sund.
								45. BUCCONIDÆ, Sund.
								46. RIHAMPHASTIDÆ, Bonap.
								47. CUCULIDÆ, Sund.
								48. PICIDÆ, Bonap.
								49. PSITTACIDÆ, Bonap.



PHASIANUS TORQUATUS.
(The Ring-necked Pheasant.)



LOPHOPHORUS IMPEYANUS
(Impeyan Lophophorus.)



BONASA UMBELLUS.
(The Ruffed Grouse.)



TETRAO CANADENSIS.
(The Canadian Grouse.)



PERDIX FRANCOLINUS
(The Common Francolin.)



ORTYX CALIFORNICA
(The Californian Ortyx.)

ORDER STRISORES. WIDE-MOUTHED BIRDS.

By Lilljeborg's arrangement this order comprehends seven interesting families, which are characterized as follows:—

STRISORES,	Anterior toes	connected by a movable skin, though sometimes more or less united.	Secondaries	rather long, and passing beyond base of tail.	Anterior toes at base	Feet	large, with tarsus quite long, or moderate, sometimes rather short	Secondaries long;	35. CAPRIMULGID.E, Sund.
								Hinder toe generally versatile forwards	36. CYPSSLLID.E, Sund.
		not connected by a movable skin, though sometimes more or less united.	Secondaries	rather long, and passing beyond base of tail.	Anterior toes united	Bill	small, with tarsus short	Hinder toe not versatile	37. TROCHILID.E, Sund.
								versatile downwards	38. CORACID.E, Sund.
		not connected by a movable skin, though sometimes more or less united.	Secondaries	rather long, and passing beyond base of tail.	Anterior toes at base	Feet	Bill straight, or little bent, curved	Bristles rigid	39. MEROPID.E, Sund.
								large, with tarsus quite long, or moderate, sometimes rather short	40. ALCEDINID.E, Gray.
		not connected by a movable skin, though sometimes more or less united.	Secondaries	rather long, and passing beyond base of tail.	Anterior toes at base	Feet	Bill straight, or little bent, curved	large, with tarsus quite long, or moderate, sometimes rather short	41. BUCEROTID.E, Sund.

The subdivisions of these groups are thus characterized:—

STRISORES,	CAPRIMULGID.E	{ pectinated inside. Bill weak	Caprimulginae, Bonap.
		Nail of middle toe not pectinated. Bill stout	Steatornithinae, G. Gray.
	CYPSSLLID.E	Hallux { versatile forwards	Cypselinae, Bonap.
		{ not versatile	Collocaliae.
	TROCHILID.E	Anterior toes at base { disconnected	Trochilinae, Bonap.
		{ connected	Phaethornithinae, G. Gray.
	CORACID.E	Bill with margins { entire	Coraciinae, Bonap.
		{ serrated	Priotelinae, Bonap.
	MEROPID.E	Bill at base { compressed	Meropinae, Bonap.
		{ not compressed	Aegococcinae, Bonap.
	ALCEDINID.E	Bill at base	Halcyoninae, G. Gray.
			Bucrotinae, Bonap.
	BUKEROTID.E	Bill at base	

FAMILY BUCEROTID.E. HORNILLS.

These strange-looking birds, characterized by the enormous development of the beak, are natives of India and Africa. Not only is the beak of immense magnitude, but the upper mandible is furnished with projecting appendages, adding greatly to its entire dimensions, and in some species encroaching over the top of the head. These appendages increase with age. In young birds they are very small, and their figure is undefined, and it is gradually that they acquire their enormous dimensions. The immense beak, thus furnished, seems to be heavier than it is (and it is by no means light), for the additional appendage is cellular internally; the edges of both mandibles are roughly notched.

M. Lesson sums up the habits of the Hornills thus:—

"Those of Africa live on carrion; those of the East Indies seek for fruits, especially nutmegs, and their flesh thence acquires a delicious flavor. Their flight is performed by repeated strokes of the wings, and the air which they displace, joined to the clattering of their mandibles, occasions a great and very disquieting noise in the forests when the cause is unknown. This noise, capable of inspiring terror, does not ill resemble those flaws of rough

and sudden winds which arise so unexpectedly between the tropics, and blow so violently. The Europeans established at the Moluccas think that the furrows, which are seen on the bill of the Hornbills, are the result of age, and that each furrow signifies a year, whence the name of Jerarvogel, which they give to these birds."

Mr. Swainson remarks that the Hornbills are gregarious, noisy birds, generally of a very large size, and are restricted to the Old World; that they are omnivorous, feeding both on animals and vegetables; that some, however, seem only to partake of the latter food, while others, upon the authority of Le Vaillant, feed upon carrion.

The *Buceros curvatus*, dissected by Mr. Owen, was observed to be more attached to animal than to vegetable food, and would quit any other substance if a dead mouse was offered to it. This it would swallow entire, after squeezing it twice or thrice with the bill, and no castings were noticed. Mr. Owen, however, adds, that Petiver has borne testimony to its regurgitating habits.

The progressive motion of these birds is by hopping or jumping along. Major General Hardwicke expresses surprise at this, and at their perching with such security, as their feet are formed for walking, and better suited to the ground than the trees—an error which the consideration of the form, and shortness of the tarsi, the structure of the toes, and the general contour of the birds might, one would think, have prevented.

Active and alert, notwithstanding the magnitude of their beaks, these birds lightly traverse the branches of the forest, and leap from one to another, till the highest is attained; they then often stop and utter a loud, roaring sound, which may be heard at a considerable distance, and is alarming to those who do not know whence it proceeds. The noise thus uttered, and which is, most probably, their call-note, throws a light upon the design of the hollow protuberance surmounting the bill: it acts as a sounding-board, increasing the reverberation of the air. With regard to the huge beak itself, many conjectures have been entertained as to its peculiar uses. It has been suggested as a reason for its development, that it perhaps constitutes a necessary weapon of defence against monkeys and other animals which may seek to assail its nest, while some have supposed that it might be employed in dragging snakes and lizards from their lurking-places, or young birds and eggs from the recesses of the trunks of aged trees.

The Crowned Tock (*Buceros coronatus*) was found by Le Vaillant, associating in flocks of over five hundred in number in Africa, feeding on the remains of an elephant which had been slain by the hunters. They manifested no alarm at the approach of observers, but continued their feast without interruption.

FAMILY ALCEDINIDÆ. KINGFISHERS.

In this group occur the *Halcyoninæ*, or Crab Hunters, of Gray, and the *Alcedininæ*, or true Kingfishers.

In the first-named division, the birds are confined to the Old World, the species of *Dacelo* being found in Australia and New Guinea: those of *Tynysiptera* occurring in New Guinea and the Philippine Islands; those of *Halcyon* being found in Africa, India, Australia, and the islands of the South Seas, and the species of *Ceyx* in India and its archipelago.

This author, in describing the characteristics of the typical genus *Halcyon*, says, —

"These birds generally reside, singly or in pairs, in the moist, open forests, or jungles on the sides of rivers and brooks, though some species are rarely observed in the neighborhood of water, while others frequent cultivated places and plains. When flying, they usually utter a loud, rattling scream. They often sit for a long time on a pole or the lower branch of a tree, watching the space around them for the appearance of small reptiles, fish-crabs, insects and their larvae, which constitute their chief subsistence. Some species examine the flowers of the cocoa-nut trees for the insects that are found within them. The nest is formed in the hollow trunks of trees, and the eggs are usually three or four in number."

Of the sub-family *Alcedininæ*, the common Kingfisher (*Alcedo ispira*) of Europe, and the Belted Kingfisher of America, are types.

"The European Kingfisher," says an English writer, "is common in most parts of Europe; and there are few of our streams and rivers, flowing through fertile meads, abounding with fish, over which this beautiful but voracious bird may not be seen glancing backwards and forwards, its metallic hues glittering in the sun. Occasionally it hovers at a moderate elevation over the water, and then darts down, with astonishing velocity and suddenness, on some unwary fish, which, heedless of its foe, ventures near the surface, and which is seldom missed by the keen-eyed bird. The ordinary manner, however, in which the Kingfisher captures its funny prey, is by remaining quietly perched on some stump or branch overhanging the water, and then intently watching, with dogged perseverance, for the favorable moment in which to make its plunge: it marks the shoals of minnows gliding past, the trout lurking beneath the concealment of some stone, or in the shadow of the bank, the roach and dace pursuing their course. At length, attracted by a floating insect, one rises to take the prize; at that instant, like a shot, down descends the glittering bird, the crystal water scarcely bubbling with its plunge; the next moment it reappears, bearing its victim in its beak, with which it returns to its resting-place; without loosing its hold, it passes

the fish between its mandibles, till it has fairly grasped it by the tail; then, by striking smartly its head three or four times against the branch, ends its struggles, reverses its position, and swallows it whole. Quiet, secluded nooks, seldom disturbed by the intrusion of any save the 'honest angler,' sheltered spots of the river, margined with alders and willows; mill-dams, surrounded by tranquil, pastoral scenery, are the favorite haunts of this bird. Its mate is its only companion, and both labor assiduously in the support of their young. The place chosen for incubation is the bank of the river, where it is steep or overhanging, and here it either constructs or appropriates to itself a burrow, two or three feet in extent, bearing diagonally upwards. It is said to select not unfrequently the old burrow of a water-rat, but of this we are not convinced. At all events, we have seen the holes of the Kingfisher half way down the steep and perfectly perpendicular face of banks, which the water-rat could not have made, and which, we have no doubt, were the work of the birds themselves. At the end of the gallery is a little chamber, and here, without making any nest, the female lays her eggs, from five to seven in number, and of a clear, pinky white. While engaged in the work of incubation, the female is supplied by her industrious mate; and as the fish-bones and scales are disgorged (for, like owls, the Kingfisher recasts the indigestible parts of its food), a circle of these *rejecta* surrounds the eggs, which, after the young are hatched, is greatly increased, and hence has arisen the supposition—that of pellets of fish-bones is the nest composed. The young are clamorous for food, uttering an incessant cry: they soon acquire their brilliant plumage, and, when able to leave their abode, follow their parents, and, resting on a branch in some lonely retreat, tax the industry of their parents. They are, however, soon able to fish for themselves.

"The Kingfisher performs a sort of limited migration. When winter sets in, and drives the fish from the shallows to deep and sheltered bottoms, freezes the mill-dams, or coats with ice the sluggish basin, worked out by the river's current in rich alluvial soil, these birds wander from the interior to the coast, and frequent the mouths of rivulets, entering large, navigable rivers, dikes near the sea, and similar places, especially on the southern portion of our island."

FAMILY MEROPIDÆ. BEE-EATERS.

Mr. Swainson is of opinion that the *Meropidæ*, or Bee-eaters, succeed the swallows, and says of the *Merops apiaster*, that it annually visits Italy in flocks of twenty or thirty, and may be seen skimming over the vineyards and olive plantations with a flight much resembling the swallow, though more direct and less rapid.

The common Bee-eater (*Merops apiaster*) is an example of the family.

This brilliant species, which occasionally wanders as far westward as the British Isles, is a summer visitant to the southern and eastern provinces of Europe: it is common in Sicily, Italy, Spain, Greece, Turkey, &c., whence it retires into Africa on the approach of winter. In Spain, which it enters by way of Gibraltar, it makes its appearance generally during the first week in April, in flocks of forty or fifty, sometimes at a considerable elevation, at other times skimming low, and uttering a shrill whistle, heard at a considerable distance. They thus give chase to various insects,—bees, wasps, beetles, grasshoppers, and butterflies,—catching them on the wing with great address. Bee-eaters haunt rivers and streams, and may be seen coursing up and down in pursuit of their prey, and glittering in the sun with metallic brilliancy. In their habits these birds resemble the kingfisher: they breed in holes, which they burrow in steep banks overhanging the river, at the extremity of which, in a nest, according to Selby, the eggs are laid. These are of a pure white, and from five to seven in number. It is observed also, that, like the kingfisher, which recasts the bones and scales of fishes, these birds disgorge the wing-cases, and other indigestible parts of their insect food, rolled up in the form of small pellets.

FAMILY CORACIDE. ROLLERS.

The European Roller (*Coracias garrula*) is the type of this group.

This species is wild, shy, restless, and fierce, frequenting, by preference, deep forests of oak and birch, where its harsh cry may be often heard. The Roller has been observed falling through the air like a tumbler pigeon. Temminck states that it makes its nests in the holes of trees, where it lays from four to seven eggs of a lustrous white. Vieillot states that, in Malta, where trees are scarce, the bird builds on the ground. In Barbary, it has been observed to form its nest on the banks of the Shelli, Booberak, and other rivers; and Pennant remarks that, where trees are wanting, it nests in clayey banks. These last modes of nidification bring it very close to the bee-eaters and kingfishers, whose eggs quite resemble those of the Roller in color and shape, varying only in size. The male assists in incubation. The food is varied, according to Temminck, who enumerates moles, crickets, cockchafer, grasshoppers, millepedes, and other insects, slugs and worms.

FAMILY TROCHILIDE. HUMMING BIRDS.

In this division are placed the two groups—*Phaethornithinae* of Gray, and *Trochilinae*, or Humming Birds proper.

The Humming Birds are among the smallest and most brilliant of the feathered race. Winged gems, they glance, with dazzling effulgence, as they dart along, or hover over the fragrant flowers. No birds excel them

in powers of flight; their long and narrow wings are admirably adapted for aerial progression. The quill feathers are stiff, firm, and elastic, and furnished with rigid shafts, in some instances singularly developed. The tail is variable. The plumage is close and compact, and resembles an arrangement of fishes' scales, glittering, in the males, with metallic lustre. The tarsi are very small and short; and the toes, three before and one behind, are very delicate. The ground is never their resting-place: they perch on slender twigs, but are mostly seen on the wing.

The beak is long and slender, but very variable in its form, being straight, curved, and, in some species, even turned up. The tongue is long, bifid, or split into two filaments, tubular, and capable of being darted out to a considerable distance. As in the woodpeckers, it is the principal instrument by means of which they obtain their food, viz., insects of various kinds, and the nectar of flowers; and it is protruded by the same arrangement of the cartilaginous continuation of the *os hyoides* winding round the skull to the forehead. With respect to the tongue itself, Lesson describes it as composed of two musculo-fibrous cylinders, soldered to each other so as to resemble, in some degree, a double-barrelled gun; but these tubes towards the tip become separated and enlarged, each presenting a little blade, which is concave within, and convex externally. In order that this tubular tongue may be projected upon the aliments, which its terminations are appointed to seize and retain, the *os hyoides*, which supports it, is formed of two bony plates or straps, which separate, pass below the cranium, reascend over the bones of the occiput, and proceed to form a point of resistance or fulcrum by their reunion on the forehead. The result of this disposition, when brought into play by the muscles of the tongue, is a great power over the muscular tubes which compose the organ of taste. The two small blades, of elongated, spoon-like termination, seize the insects or lick up the honeyed exudations, which are on the instant carried to the aperture of the œsophagus by the elasticity and contractility of the two tubes, and forthwith swallowed. The long and slender bill comes in admirably in aiding to insert the tongue in the nectary of flowers.

These gorgeous birds are all natives of America, and that great archipelago of islands between Florida and the mouth of the Orinoco, together with the mainland of the Southern Continent until it passes the Tropic of Capricorn, literally swarms with them. In the wild and uncultivated parts, they inhabit those forests of magnificent timber, overhung with *lianas* and the superb tribe of *Bignoniaceæ*, the huge trunks clothed with a rich drapery of parasites, whose blossoms vie in tints, if not in brilliancy, with their winged riflers. In the cultivated parts, they abound in the gardens, and seem to delight in society, becoming very familiar; feeling confidence in their

own powers, they will ever hover about one side of a shrub while flowers or fruits are picked from the opposite. As we recede from the tropics on either side the numbers decrease, though some species are found in Mexico, and others in Peru, which do not appear to exist elsewhere. Thus Mr. Bullock discovered several species at a high elevation, and consequently low temperature, on the lofty table-lands of Mexico, and in the woods in the vicinity of the snowy mountains of Orizaba; while Captain King, in his survey of the southern coasts, met with numerous members of this diminutive family flying about in a snow storm, near the Straits of Magellan, and discovered two species in the remote island of Juan Fernandez. "Two species only spread far into the Northern Continent of America; the one, the Ruff-necked Humming Bird, which was discovered by Captain Cook in Nootka Sound, and has been traced by Kotzebue to 61° along the western shores; the other, the Northern or Ruby-throated Humming Bird, so beautifully described by Wilson. This species has been obtained from the plains of the Saskatchewan, and was found breeding, by Mr. Drummond, near the sources of the Elk River. It is known to reach as far north as the fifty-seventh parallel."

The velocity with which the Humming Birds glance through the air is extraordinary, and so rapid is the vibration of their wings that the action eludes the sight: when hovering before a flower, they seem suspended as if by some magic power, rather than by the vigorous movement of their rigid pinions, which, however, produce a constant murmur or buzzing sound, whence the English title by which we designate these birds, and the Creole epithets in Cayenne and the Antilles, viz., Murmures, Bourdons, and Froufrous.

It has been frequently and justly observed that in their mode of flight the Humming Birds closely resemble the sphinx-moths or the dragon-flies. Mr. Darwin, in his admirable "Journal," states, that while at Bahia, he started early one morning, and walked to the top of the Gavia or Topsail Mountain. "The air was delightfully cool and fragrant, and the drops of dew were still glittering on the leaves of the large liliaceous plants which shaded the streamlets of clear water. Sitting down on a rock of granite, it was delightful to watch the various insects and birds as they flew past. The Humming Birds seemed particularly fond of such shady, retired spots: whenever I saw these little creatures buzzing round a flower, with their wings vibrating so rapidly as to be scarcely visible, I was reminded of the sphinx-moths; their movements and habits are, indeed, in many respects, very similar."

Bullock and Wilson both notice the surprising rapidity of the vibrations of their wings. The former, speaking of specimens caged, says, that in a

space barely sufficient for them to move their wings, they will keep their bodies in the air, apparently motionless, for hours together. There are, however, exceptions to this rule. Mr. Darwin, describing the *Trochilus gigas*, which, as he observed, had arrived in the neighborhood of Valparaiso in numbers a little before the vernal equinox, adds,—

" It comes from the parched deserts of the north, probably for the purpose of breeding in Chili. When on the wing, the appearance of this bird is singular. Like the others of the genus, it moves from place to place with a rapidity, which may be compared to a syrphus amongst dipterous insects, and a sphinx amongst the moths; but whilst hovering over a flower, it flaps its wings with a slow and very powerful movement, totally different from that vibratory one, common to most of the species, which produces the humming noise. I never saw any other bird the force of whose wings appeared so powerful in proportion to the weight of its body. When hovering by a flower, its tail is constantly expanded and shut like a fan, the body being kept in a nearly vertical position. This action appears to steady and support the bird between the slow movements of its wings. Although flying from flower to flower in search of food, its stomach generally contained abundant remains of insects, which, I suspect, are much more the object of its search than honey is. The note of this species, like that of nearly the whole family, is extremely shrill."

These brilliant creatures are an intrepid, daring race, and extremely pugnacious, and cannot endure the approach of one even of their own species, still less of any other bird, near their breeding-places. Of one minute but beautiful species, the Mexican Star, Mr. Bullock says,—

" When attending their young, they attack any bird, indiscriminately, that approaches the nest. Their motions, while under the influence of anger or fear, are very violent, and their flight rapid as an arrow. The eye cannot follow them, but the shrill, piercing shriek which they utter on the wing, may be heard when the bird is invisible. They attack the eyes of the larger birds, and their sharp, needle-like bill is a truly formidable weapon in this kind of warfare. Nothing can exceed their fierceness when one of their own species invades their territory during the breeding-season: under the influence of jealousy they become perfect furies, their throats swell, their crests, tails, and wings expand, they fight in the air, uttering a shrill noise, till one falls exhausted to the ground."

It would appear, from Mr. Bullock's statement, that Humming Birds often avail themselves of the insects caught in spiders' webs; not, however, without the spiders endeavoring, not to devour, but to drive them away. "The house," he writes, "I resided in at Xalapa for several weeks on my return to Vera Cruz, was only one story high, enclosing, like most of the Spanish

houses, a small garden in the centre, the roof projecting six or seven feet from the walls, covering a walk all round, and leaving a small space only between the tiles and the trees which grew in the centre. From the edge of these tiles to the branches of the trees in the garden the spiders had spread their innumerable webs so closely and compactly that they resembled a net. I have frequently watched, with much amusement, the cautious peregrinations of the Humming Bird, who, advancing beneath the web, entered the various labyrinths and cells in search of entangled flies; but, as the larger spiders did not tamely surrender their booty, the invader was often compelled to retreat. Being within a few feet, I could observe all their evolutions with great precision: the active little bird generally passed once or twice round the court, as if to reconnoitre his ground, and commenced his attack by going carefully under the nets of the wily insect, and seizing, by surprise, the smallest entangled flies, or those that were most feeble. In ascending the angular traps of the spider, great care and skill were required; sometimes he had scarcely room for his little wings to perform their office, and the least deviation would have entangled him in the complex machinery of the web, and involved him in ruin. It was only the works of the smaller spiders that he durst attack, as the largest rose in defence of their citadels, when the besieger would shoot off like a sunbeam, and could only be traced by the luminous glow of his resplendent colors. The bird generally spent about ten minutes in this predatory excursion, and then alighted on a branch of an *avocata* to rest and refresh himself, placing his crimson, star-like breast to the sun, which then presented all the glowing fire of the ruby, and surpassed in lustre the diadem of monarchs."

The nests of the Humming Birds are most beautiful, compact structures, with exquisite finish and nicety of arrangement. Some are composed of the finest silky down, or cotton of a delicate straw yellow, soft, light, and compact, attached to the end of a twig, and concealed by leaves. In some cases the outside is formed of fine moss, lichens, &c., investing a compact bed of the down of plants, cotton, and even spiders' webs.

FAMILY CYPSELIDÆ. SWIFTS.

The Chimney Swallow, or Swift (*Chetura pelasgia*) of America, and the common Swift of Europe, furnish familiar types of the sub-family *Cypselinæ*, and the Esculent Swallow (*Collocalia esculenta*) of the *Collocalinæ*.

The Chimney Swallow is a well-known bird in the eastern United States. It arrives in the latitude of New England, in great numbers, from the south, from about the 1st to the 10th of May. Immediately on arriving the birds pair, and commence building. The nest is usually constructed in an unused

flue of a chimney ; but, before the country was settled, they bred, and we have no doubt that great numbers of them, in thinly-settled districts, still breed, in hollow trees. The nest is composed of twigs, which are glued together, and to the side of the chimney, with the saliva of the bird. It is lined with a few feathers and straws. The strength of these structures is wonderful, and they are so durable that we have known of instances of their remaining in the chimney during three seasons. Usually the bird displays great sagacity in the choice of a location for a nest, in securing protection from storms and from the attacks of animals ; but occasionally the nest is built in a chimney, open at the top sufficiently wide to permit the rain to trickle down the sides : the result is, that the moisture softens the glue by which the nest is attached to the chimney, and it is, with its living contents, precipitated to the bottom. Again, if the nest is built too low in the chimney, the young or eggs furnish agreeable food for rats, which, unfortunately, are sometimes found in dwelling-houses in the country in uncomfortable numbers. The eggs are generally four or five in number, pure white in color, rather long in shape.

This species is somewhat nocturnal in its habits. From earliest dawn until seven or eight in the morning, it is busy in the pursuit of insects : it then retires to its roosting-places in the chimneys, and is seldom seen until late in the afternoon. From early twilight until late in the night it is again actively employed ; and, having heard its notes, as it sped through the air, often as late as midnight, we have no doubt that, in pleasant weather, it is busy through the whole night.

In descending the chimneys, where their young are, the birds fly rapidly until they are immediately over them, when, partially closing their wings, they drop suddenly, and with apparent ease, down the flue. In ascending, the noise of their wings in the chimney is like that of a distant thunder. The flight of these birds is very rapid, surpassing, we think, that of any other species : it is so peculiar,—the long wings vibrating in short, quick, energetic strokes,—that it furnishes a ready means of distinguishing it from all other species at a great height.

About sunset the great multitudes of these birds are out, and the numbers of insects they destroy must be immense. Everywhere they may be seen : away up in the blue sky, as far as the eye can reach, they are coursing in wide-extended circles, chasing each other in sport, and even caressing and feeding their mates while on the wing ; a little lower, they are speeding over the tops of trees, gleaning the insects that have just left the foliage ; over the surface of the lake or river they fly so low, in the pursuit of aquatic insects, that their wings often touch the water : everywhere they are busy. Truly, they are deserving of much better treatment than they too often re-

ceive at the hands of the farmer, to whom they are his best friends; yet it is a fact, that in a great many sections they are driven from the chimneys of the farm-houses, and even destroyed, at every opportunity.

About the 10th of August the Chimney Swallow, in large, scattered flocks, leaves for the south, and spends the winter in Honduras and the West Indies. On returning, in the spring, the same pair occupy the chimney used in the previous season, as has been proved by actual observation.

The nest of the Esculent Swallow is regarded as a great delicacy by the Chinese. "These nests are composed of a mucilaginous substance, usually more or less mixed with fragments of grass, hair, and similar materials: they are attached to the surface of rocks in caverns, and the birds always build in communities. It was formerly supposed that the mucilaginous matter employed in the construction of the nests was obtained from sea-weeds eaten by the birds; but it is now ascertained, beyond a doubt, that the substance in question is secreted by greatly-developed salivary glands. These birds are found in great abundance in all parts of the Eastern Archipelago, and on the continent of India. The nests are collected in great quantities, and constitute an important article of commerce with China."

FAMILY CAPRIMULGIDÆ. NIGHT JARS, OIL BIRDS, AND GOAT-SUCKERS.

The *Steatornithinæ*, or Oil Birds, are among the most interesting of this group.

The Guacharo (*Steatornis Caripensis*) is thus described:—

This extraordinary bird was discovered by Baron Humboldt in the cavern of Caripe, called Cueva del Guacharo, in the province of Cumana, which it haunts in thousands. These birds quit the cave only at nightfall, especially when there is moonlight; and Humboldt remarks that it is almost the only frugivorous night-bird yet known. It feeds on very hard fruits (an exception to the rule among the Caprimulgidae), and the Indians assured him (though we place little dependence on their statement) that it does not pursue either the hard-winged insects, or the moths that serve as the food of this tribe of birds. It is, he states, difficult to form any idea of the horrible noise made by thousands of the Guacharo birds in the dark recesses of the cavern, whence their shrill and piercing cries strike upon the vaulted rock, and are repeated by the echo in the depths of the grotto. By fixing torches of copal to the end of a long pole, the Indians showed the nests of these birds, fifty or sixty feet above the heads of the explorers, in funnel-shaped holes, with which the cavern roof is pierced like a sieve.

Once a year, near midsummer, the Guacharo cavern is entered by the Indians. Armed with poles, they ransack the greater part of the nests,

while the old birds hover over the heads of the robbers, as if to defend their brood, uttering horrible cries. The young, which fall down, are opened on the spot. The peritoneum is found loaded with fat, and a layer of the same substance on the abdomen forms a kind of cushion between the bird's legs. At the period above mentioned, which is generally known at Caripe by the designation of the "oil harvest," huts are built by the Indians with palm leaves, near the entrance, and even in the very porch of the cavern. There the fat of the young birds just killed is melted in clay pots over a bush-wood fire; and this fat is named butter or oil (*manteeca* or *aceite*) of the Guacharo. It is half liquid, transparent, inodorous, and so pure that it will keep above a year without becoming rancid. In the kitchen of the monks of the convent of Caripe no other oil is used, and Humboldt never found that it imparted a disagreeable taste or smell to the aliments. The quantity of very pure *manteeca* collected does not exceed one hundred and fifty, or one hundred and sixty bottles, each being sixty cubic inches; the rest, which is less transparent, is preserved in large earthen vessels: the whole hardly seems to correspond with the immense annual carnage of birds. The use of the Guacharo oil is very ancient, and the race of Guacharo birds would have been extinct long since if several circumstances had not contributed to their preservation. The natives, withheld by superstitious fears, seldom dare to proceed far into the recesses of the cavern. Humboldt had great difficulty in persuading them to pass beyond the outer part of the cave, the only portion of it which they visit annually to collect the oil; and the whole authority of the *padres* was necessary to make them penetrate as far as the spot where the floor rises abruptly at an inclination of sixty degrees, and where a small, subterraneous cascade is formed by the torrent. In the minds of the Indians this cave, inhabited by nocturnal birds, is associated with mystic ideas, and they believe that in the deep recesses of the cavern the souls of their ancestors sojourn.

Of the *Cypriñulgiue*, our American Night Hawks, Whippoorwills, the European Night Jar, are familiar examples.

The Night Hawk, or Bull Bat, is distributed generally over the North American continent, and its habits are well known. It arrives in the latitude of New England about the 10th of May. At this time great numbers may be observed, at early twilight, coursing through the air in different directions, sometimes at a great height, sometimes just above the trees in the country, or houses in the city; occasionally, very near the earth or water, or, when near the sea-coast, but just above the marshes, where they destroy great numbers of insects. Their flight is very rapid, their long wings giving quick, powerful sweeps; and, as they dart about in many eccentric movements, busily gleaning their food, they utter, at oft-repeated inter-

vals, their short note or *squeak*, which almost exactly resembles that of the common snipe.

About the middle of May, or by the 20th of that month in Maine, the male commences his attentions to the female. His movements at this time are interesting, and, from their common occurrence, familiar to all who live in the country. At early evening, and in cloudy weather throughout the greater part of the day, he ascends into the air, and when he has attained a considerable height, partially closing his wings, he drops with great velocity through the distance of seventy-five or one hundred feet, sometimes nearly to the earth. The sound made by the air passing through the wing-quills is so loud that we have often heard it at certainly the distance of half a mile: it resembles, as Nuttall truly says, the sound produced by blowing into the bung-hole of an empty hogshead. This act is often repeated, the bird darting about at the same time in every direction, and uttering his sharp *squeak*. Wilson was of the opinion, that this habit of the Night Hawk was confined to the period of incubation; the male acting in this manner, as he thought, to intimidate any person from approaching the nest. We have had abundant opportunities for observing the bird in all times of the summer, and during its stay with us; and we would unhesitatingly affirm, that, from the time of early courtship, until the young are hatched, if not after, the male acts in this manner.

This species constructs no nest, but lays its eggs on the bare ground, in a slight hollow scratched by the female, or often on a bare rock. We have found numbers of these eggs, particularly in the northern parts of Maine, where, in walking over a pasture or rocky field, we have flushed sometimes a bird in every ten rods. We remember a ledge of rocks back of the settlement known as Wilson's Mills, which seemed a favorite breeding-place for these birds; and, in the space of every four or five rods, a female was sitting on her eggs. The eggs are two in number, elliptical in shape, of a dirty-white color, which is covered with fine dottings of different shades of brown, with obscure markings of slate color, and some spots of lavender.

The male assists the female in incubating, as we have witnessed many times. When perched by her, on a tree or fence-rail, during the light of midday, he always sits *along* the limb or rail, instead of *across* it, a peculiarity which is also noticeable in the Whippoorwill. Some authors, in speaking of this fact, explain it by noticing the comparatively small size of the feet, and apparent weakness of the legs. We think this can hardly be a sufficient cause; for both these birds, while on the ground, can run with considerable speed, and, if captured, cannot only perch *across* the finger of a hand, or the back of a chair, as we have often proved, but can rest on one foot, drawing the other up into the feathers of the belly, like other birds.

About the 20th of August, after the young have become able to provide for themselves, all the families in a neighborhood assemble in a large, scattered flock; and, after having become completely recruited from the labors of incubation, they all leave for the south.

The Whippoorwill is also well known to the inhabitants of the rural districts in the United States, east of the great central plains. It arrives from the south generally about the second week in May. Its habits are not well known, as it is not a very common species, and it inhabits the most secluded spots in the deep woods; but its song is well known to all, as are its nocturnal wanderings in search for insect food. This bird, as also the Night Hawk, is, to the farmer, one of the most valuable among the feathered tribes: its food consists almost entirely of night-flying *Lepidoptera*, and the number of these insects destroyed is immense.

The peculiar song of this bird is heard at early eve, and until late into the night, during the mating and part of the breeding seasons. It is not uttered in the depths of the wilderness alone; but the bird, perching on the well-sweep, on the eaves of a low shed, or even on the door-sill of the farmer's house, pours out its melancholy strain. The description, by Alexander Wilson, of the habits of this bird, is so accurate and comprehensive, that we will not presume to attempt another. He says,—

"The notes seem pretty plainly to articulate the words, which have been generally applied to them, *whip-poor-will*, the first and last syllables being uttered with great emphasis, and the whole in about a second to each repetition; but, when two or more males meet, their whippoorwill altercations become much more rapid and incessant, as if each were straining to overpower or silence the other. When near, you often hear an introductory cluck between the notes. At these times, as well as at almost all others, they fly low, not more than a few feet from the surface, skimming about the house and before the door, alighting on the wood-pile, or settling on the roof. Towards midnight they generally become silent, unless in clear moonlight, when they are heard, with little intermission, till morning. If there be a creek near, with high, precipitous, bushy banks, they are sure to be found in such situations. During the day they sit in the most retired, solitary, and deep-shaded parts of the woods, generally on high ground, where they repose in silence. When disturbed, they rise within a few feet, sail low and slowly through the woods for thirty or forty yards, and generally settle on a low branch or on the ground. Their sight appears deficient during the day, as, like owls, they seem then to want that vivacity for which they are distinguished in the morning and evening twilight. They are rarely shot at or molested; and, from being thus transiently seen in the obscurity of dusk, or in the deep umbrage of the woods, no wonder their particular

markings of plumage, should be so little known, or that they should be confounded with the Night Hawk, which, in general appearance, they so much resemble. The female begins to lay about the second week in May, selecting, for this purpose, the most unfrequented part of the wood, often where some brush, old logs, heaps of leaves, &c., had been laying, and always on a dry situation."

The Whippoorwill constructs no nest, but lays its eggs, which are two in number, in a slight hollow which it scratches in the earth, usually near a rock or fallen trunk of a tree. These eggs are of an elliptical form, being as large at one end as at the other; their ground color is a delicate creamy white, with blotches, lines, and spots of different shades of light brown and lavender: taken altogether, it is one of the handsomest eggs found in New England. The length of several specimens before me varies from 1.21 to 2.27 inches; breadth, from .75 to .79 inch. The bird commences laying about the last week in May, and the period of incubation is fourteen days.

The young are soon able to walk, and in a few days can run with considerable speed; and they hide with such adroitness, that it is a work of no little difficulty to capture them. The female, when her young are discovered, immediately throws herself before the intruder, counterfeiting lameness so well, that, unless he is well acquainted with the habits of birds, he will quickly be misled into following her. As soon as the young birds are able to shift for themselves, they are turned adrift by their parents, and are seen only singly, or at most in pairs, during the remainder of their stay. By the latter part of August, or seldom later than the 10th of September, all of them depart for the south, the old males remaining a few days later, uttering, occasionally, their song, but always in the woods, or in localities far removed from human habitation.

The European Night Jar is known by a variety of names, such as Jar-Owl, Fern-Owl, Wheel-Bird, Milchsaüger, Nachtsehwalbe, &c. It feeds on flies, moths, and beetles. "Its powers of flight are wonderful, exceeding even those of the swallows; the jarring sound, which gives name to the bird, is uttered sometimes while flying, but usually when it is at rest: it seems to be produced in the same manner as the purring of a cat, and resembles it, though louder. It appears that goat-sucking is not the only crime laid to this bird, for White, of Selborne, informs us that 'the country people have a notion that the Fern-Owl, which they call also *Puckeridge*, is very injurious to weanling calves, by inflicting, as it strikes them, the fatal distemper known as *puckeridge*.' Thus does this harmless, ill-fated bird fall under a double imputation, which it by no means deserves, in Italy, of sucking the teats of goats, whence it is called the *Caprimulgus*, and with us of communicating a deadly disorder to the cattle."

ORDER ACCIPITRES. BIRDS OF PREY.

THIS order, one of the largest and most interesting, contains a great variety of forms, which are scattered over all portions of the globe.

The birds of prey are divided into two sections,—the diurnal and nocturnal,—which are characterized as follows:—

		Section DIURNAL.	
ACCIPITRES	ECC.	lateral. Claw of posterior toe, not larger than claw of median anterior toe. Claws obtuse. Head more or less naked..... larger than claw of median anterior toe. Claws acute. Head feathered..... directed forwards..... 	22. VULTURIDÆ, Sun. 23. FALCONIDÆ, Sun. 24. STRIGIDÆ, Sun.
		Section NOCTURNAL.	

These families are subdivided into several groups, each with well-marked characters.

ACCIPITRES.

VULTURIDÆ,	Haloxys and its nail	less than anterior toe and inserted above the base.....	Cathartidæ, De Latr.	
	bearded.....	about as long as inner toe.....	Turcoridæ, Blag.	
Chin	feathered.....	feathered.....	Gypactridæ, Bonap.	
1	not bearded Behind ears....	feathers.....	Polyboridæ, Bonap.	
2	Bell	Wings	Outer toe \backslash variable. Pterostomidæ, Bonap.	
3		Leath covered with.....	Anterior surface of tail.....	
4			feathered, or more covered with fine plates.....	Apalidæ, Swains.
5			forked or emarginated.....	Melinae, Bonap.
6				
		not passing beyond middle of tail. Two median elongated.....	Gymnogene, Bonap.	
		tail feathers.....	Asturidæ, G. Gray.	
		feathered behind tip of upper incisor.....	Aluco, Bonap.	
		more or less distinct collar, formed of teeth.....	Circus, Bonap.	
STRIGIDÆ	Apteryx of cat absent. Radiate falcon incomplete with continuous tube of present. Radiate fles rounded.....		Surnidae, Bonap.	
	valve.....	{ radiate complete } pointed below, subtriangular. Nail of middle toe in the nated on inner side.....	Strigidae, Bonap.	
			Hybrididae.	

FAMILY STRIGIDÆ. THE OWLS.

Of the *Hybrididae*, the Barn Owl of Europe is a type.

This bird is spread throughout the temperate and warmer regions of Europe. It is common in England and Ireland but less so in Scotland: in the northern latitudes of the continent it is not known. The Barn Owl conceals itself during the day in deep recesses among ivy-clad ruins, in antique church-towers, in the hollow of old trees, in barn-lofts, and similar places of seclusion. At night, it sallies forth for prey, which consists of mice, rats, moles, and shrews, but, we believe, never birds. Hence it is persecuted by the farmer in vain, who suspects that it thins his dove-cot, and little knows the extent of the services which the bird renders to him. "If," says Mr. Waterton, "this useful bird caught its food by day, instead of hunting for it by night, mankind would have ocular demonstrations of its utility in thinning the country of mice, and it would be protected and encouraged everywhere. When it has young, it will bring a mouse to the nest every twelve or fifteen minutes" (that is, during the night); and he adds, "Formerly I could get very few young pigeons till the rats were excluded from the

dove-cot; since that took place, it has produced a great abundance every year, though the Barn Owl frequents it, and is encouraged all round it;" and he affirms that the pigeons neither regard it "as a bad nor suspicious character."

Mr. Thompson ("Mag. Zoöl. and Botan., Vol. II., p. 178") observes that "the White (barn) Owl is a well-known visitor to the dove-cot; and, in such a place, or rather a loft appropriated to pigeons, in the town of Belfast, I am informed, by an observant friend, that a pair once had their nest; this contained four young, which were brought up at the same time with many pigeons. The nests containing the latter were on every side, but the owls never attempted to molest either the parents or their young. As may be conjectured, the owl's nest was frequently inspected during the progress of the young birds. On the shelf beside them never less than six, and often fifteen mice and young rats (no birds were ever seen) have been observed, and this was the number they had left after the night's repast. The parent owls, when undisturbed, remained all day in the pigeon-loft." In further proof, it may be urged, that the remains of rats, mice, and occasionally beetles, have been found, to the exclusion of feathers, in the stomachs of most owls when examined. Such remains were found in the stomachs of all those opened by Mr. Thompson, and of such are the pellets cast by the owls invariably composed.*

The Barn Owl quarters the ground for food with great regularity, and drops upon it with unerring aim. Selby says it occasionally utters loud screams during its flight; and Mr. Yarrell says it screeches, but does not generally hoot. But Sir William Jardine asserts, that he shot one in the act of hooting, and that at night, when not alarmed, hooting is its general cry. It snores and hisses, and, when annoyed, snaps its bill loudly.

The Barn Owl constructs a rude nest; the eggs are three or four in number, and of a white color. The female often lays a second time before the young are able to leave the nest; hence young owls have been found late in the autumn, and even in December.

Of the *Surniini*, the genera *Nyctea* (of which the Snowy Owl (*Nyctea nivea*) is an example), *Scops* (of which the Little Red or Mottled Owl is well known), and *Bubo* (in which occurs the Great Horned Owl (*Bubo Virginianus*) of America), and *Athene* (the Burrowing Owl), all furnish examples.

Wilson describes the habits of the Great Horned Owl (one of the most interesting of this group) as follows:—

* The owl and all the hawk tribe cast up the indigestible parts of their prey, as bones, feathers, hair, claws, &c., in the form of pellets; and in the long-tenanted haunt of an owl, these are found greatly accumulated.

"His favorite residence is in the dark solitudes of deep swamps, covered with a growth of gigantic timber; and here, as soon as the evening draws on, and mankind retire to rest, he sends forth such sounds as seem scarcely to belong to this world. . . . Along the mountain shores of the Ohio, and amidst the deep forests of Indiana, alone and reposing in the woods, this ghostly watchman has frequently warned me of the approach of morning, and amused me with his singular exclamations. Sometimes, sweeping down and around my fire, uttering a loud and sudden '*Waugh O! Waugh O!*' sufficient to have alarmed a whole garrison. He has other nocturnal solos, one of which very strikingly resembles the half-suppressed screams of a person suffocating or throttled."

The flight of this bird is elevated, rapid, and graceful. It sails with apparent ease in large circles, and rises and descends without the least difficulty, by merely inclining its wings or its tail as it passes through the air. Now and then it glides silently close over the earth, with incomparable velocity, and drops, as if shot dead, on the prey beneath. At other times it suddenly alights on the top of a fence, stake, or dead stump, and utters a shriek so horrid, that the woods around echo to its dismal sound. During the utterance of the deep, gurgling cries, so well described by Wilson, it moves its body, and particularly its head, in various grotesque ways, and at intervals violently snaps its bill. Its food consists of various gallinaceous birds, half-grown turkeys, domestic poultry of all kinds, ducks, grouse, hares, opossums, and squirrels; and whenever chance throws a dead fish on the shore, this bird feeds on it with peculiar avidity. The Virginian Horned Owl is very powerful, and equally spirited. Mallards, Guinea fowl, and common fowls fall an easy prey, and are carried off in its talons to the depth of the woods. "When wounded," says Audubon, "it exhibits a revengeful tenacity of spirit, scarcely surpassed by the noblest of the eagle tribe; disdaining to scramble away, it faces its enemy with undaunted courage, protruding its powerful talons, and snapping its bill. Its large, goggle eyes open and shut in quick succession, and the feathers of its body are puffed up, and swell out its apparent bulk to nearly double the natural size. In some districts it is a great nuisance to the settler, making sad havoc among his stock of poultry. Among some of the Indian nations a sort of reverential horror is entertained towards this bird, and the priests and conjurers have adopted it as the symbol of their office, carrying about with them a stuffed specimen with glass eyes, which excites general awe. This bird usually constructs a bulky nest in the forked branch of a tree, composed externally of crooked sticks, and lined with coarse grass and feathers. The eggs are three or four in number, and of a dull white."

In size, this species is nearly as large as the European representative,

the Eagle Owl, and, in the general style of coloring, is similar, the upper parts being waved and mottled with black and brownish red; a tinge of gray, as the ground color, prevails on the lower part of the back; the throat is pure white; the rest of the under surface is marked by innumerable narrow, transverse, dusky bars, on a reddish ground color, thinly interspersed with white.

Our Little Red Owl (*Scops Asio*) of America, is also another interesting species. Audubon says of it,—

"The flight of the Mottled Owl is smooth, rapid, protracted, and noiseless. It rises at times above the top branches of the highest of our forest trees whilst in pursuit of large beetles; and at other times sails low and swiftly over the fields, or through the woods, in search of small birds, field-mice, moles, or wood-rats, from which it chiefly derives its subsistence. On alighting (which it does plumply), the Mottled Owl immediately bends its body, turns its head to look behind it, performs a curious nod, utters its notes, then shakes and plumes itself, and resumes its flight in search of prey. It now and then, while on the wing, produces a clicking sound with its mandibles, but more frequently when perched near its mate or young. This I have thought was done by the bird to manifest its courage, and let the hearer know that it is not to be meddled with; although few birds of prey are more gentle when seized, as it will suffer a person to touch its feathers and caress it without attempting to bite or strike with its talons, unless at rare intervals.

"The notes of this owl are uttered in a tremulous, doleful manner, and somewhat resemble the chattering of the teeth of a person under the influence of extreme cold, although much louder. They are heard at a distance of several hundred yards, and by some people are thought to be of ominous import."

These notes almost exactly resemble the whimpering whine of a small dog, for which we have mistaken them on different occasions.

"The little fellow is generally found about farm-houses, orchards, and gardens. It alights on the roof, the fence, or the garden gate, and utters its mournful ditty, at intervals, for hours at a time, as if it were in a state of great suffering; although this is far from being the case, the song of all birds being an indication of content and happiness. In a state of confinement it utters its notes with as much satisfaction as if at liberty. They are chiefly heard during the latter part of winter, that being the season of love, when the male bird is particularly attentive to the fair one which excites his tender emotions, and around which he flies and struts much in the manner of the common pigeon, adding numerous nods and bows, the sight of which is very amusing."

As a pet, this bird is interesting and amusing. A friend of ours, who had one for a long time in captivity, writes for us the following account of its habits :—

" As I was walking through the streets of a village one day, I observed a crowd of boys around a small owl. On approaching it, I found that the bird was a young Mottled Owl. It was staring about in a dazed manner, and seemed half stupefied. I easily persuaded the boys to part with it for a trifle, and sent it home. At that time, June 15, 1867, it was, I should judge, about two weeks old, and was covered with a grayish down. I put it in a large cage, and gave it some meat, which it ate, but not readily, for it seemed frightened at the sight of my hand, and, at its near approach, would draw back, snapping its beak after the manner of all owls. It soon grew tamer, however, and, as I sat at my bench, would regard me with a wise stare, as if perfectly understanding what I was about. In a short time it took food from me without fear. I never saw it drink, although water was kept constantly by it. I fed it upon mice, birds, and butchers' meat. It was kept in its cage for about two weeks, during which time it became quite tame, but would not tolerate handling, always threatening me with its beak when my hand approached it. As the wires of its cage broke its feathers by the bird's moving about, and as it hardly seemed resigned to confinement, I opened its cage, and gave it the freedom of the room, leaving the windows open night and day. About this time I gave it the name of Scops, to which, in a little while, it would answer, when called, with a low rattle, which sounded like the distant note of the kingfisher.

" One morning Scops was missing; diligent search was made for him (we now regarded the bird as a male), but no owl could be found. Once or twice he was seen in the neighboring woods by different people, and once on the roof of a barn, but he was wild, and refused to be caught. He had been absent about a week, when, one morning, I was told my owl was out in the garden. I hastened out, and found a half-grown Newfoundland dog playing with my pet. Scops was clinging to the dog's shaggy fur with his claws, snapping his beak, and biting fiercely. I immediately rescued him, and carried him into the house: the rain was falling, and he was thoroughly wet. On arriving in his old quarters he seemed pleased, chuckling to himself after his manner. He was almost starved, and ate two full-grown bluebirds at the first meal. After this time, although enjoying the utmost freedom, he has never but once remained away more than two days at a time.

" When a bird is given him for food he takes it in his claws, invariably pulls out the wing and tail feathers first; then eats the head; then pulls out the intestines, and devours them; and then, if not satisfied, eats the remainder of the bird, feathers and all. While pulling the bird to pieces, he holds

it in his claws, and tears it with his bill. That this owl sees tolerably well in the daytime, I have proved to my satisfaction. I caught a mouse, and put it alive into an open box about two feet square. This I placed upon a bench near Scops, who was attentively watching my movements: the moment he discovered the mouse, he opened his eyes wide, bent forward, moved his head from side to side, as if to learn its exact position, and then came down upon it with an unerring aim, burying his talons deep in the head and back of the mouse; then flew with his struggling prey to his perch, where he killed the mouse by biting it in the head and back. During the whole act he displayed considerable energy and excitement.

"Again, I have seen him pounce upon a dragon-fly, which lay disabled, buzzing on the bench: the bird went through the same manœuvres as before, striking the insect with the greatest precision, and with both feet. I think that these instances prove that the bird can see nearly as well in the day as in the night. In both the above instances the sun was not shining on the objects struck, but they were very near the window, and the light was consequently strong.

"In sleeping, Scops usually stands upon one foot, both eyes shut; but sometimes he stretches out at full length, resting on his breast. When sound asleep, he awakens instantly, and, on his name being pronounced, answers at once. I have heard him utter his peculiar, quavering note on one or two occasions only. Scops is often out of the house all night, and even past the strong light of sunrise. While flying, he moves through the air with a quick, steady motion, alighting on any object without missing a foothold. Sometimes during the day he will take a sudden start, flitting about the room like a spectre, alighting on different objects to peer about, which he does by moving sideways, turning the head in various directions, and going through many curious movements; but he always returns to his perch, and settles down quietly."

Of the Burrowing Owls, there are two species, the *A. cunicularia* and the *A. hypugaea*. These birds, from their habit of nesting in burrows in the earth, which they have dug, or which were dug by other animals, are worthy of more than a passing notice. From the "Thousand Miles' Walk," we copy the following account of the *Athene cunicularia*:—

"I first met with this owl on the banks of the River San Juan, in the Banda Oriental, one hundred and twenty miles west of Montevideo, where a few pairs were observed devouring mice and insects during the daytime. From the river, travelling westward thirty miles, I did not meet a single individual, but after crossing the Las Vacas, and coming upon a sandy waste, covered with scattered trees and low bushes, I again met with several.

"Upon the pampas of the Argentine Republic they are found in great numbers, from a few miles west of Rosario, on the Parana, latitude $32^{\circ} 56'$ south, to the vicinity of San Luis, where the pampas end, and a travesia or saline desert commences.

"On these immense plains of grass it lives in company with the *bizcacha*. The habits of this bird are said to be the same as those of the species that inhabits the holes of the marmots upon the prairies of western North America. But this is not strictly correct, for one writer says of the northern species, 'We have no evidence that the owl and marmot habitually resort to one burrow;' and Say remarks, 'that they were either common, though unfriendly, residents of the same habitation, or that our owl was the sole occupant of a burrow acquired by the right of conquest.' In this respect they differ from their South American relatives, who live in perfect harmony with the *bizcacha*, and during the day, while the latter is sleeping, a pair of these birds stand a few inches within the main entrance of the burrow, and at the first strange sound, be it near or distant, they leave their station, and remain outside the hole, or upon the mound which forms the roof of the domicile. When man approaches, both birds mount above him in the air, and keep uttering their alarm note, with irides dilated, until he passes, when they quietly settle down in the grass, or return to their former place.

"While on the pampas, I did not observe these birds taking prey during the daytime, but at sunset the *bizcachas* and owls leave their holes, and search for food, the younger of the former playing about the birds as they alighted near them. They do not associate in companies, there being but one pair to each hole, and at night do not stray far from their homes.

"In describing the North American Burrowing Owl, a writer says that the species 'suddenly disappears in the early part of August,' and that 'the species is strictly diurnal.'

"The *Athene cunicularia* has not these habits. It does not disappear during any part of the year, and it is both nocturnal and diurnal, for, though I did not observe it preying by day on the pampas, I noticed that it fed at all hours of the day and night on the north shore of the Plata, in the Banda Oriental.

"At longitude 66° west our caravan struck the great saline desert that stretches to the Andes, and during fourteen days' travel on foot I did not see a dozen of these birds; but while residing outside the town of San Juan, at the eastern base of the Andes, I had an opportunity to watch their habits in a locality differing materially from the pampas.

"The months of September and October are the conjugal ones. During the middle of the former month I obtained a male bird with a broken wing.



PERNIS APIVORUS
(The Honey Buzzard.)



ACCIPITER FRINGILLARIUS
(The European Sparrow Hawk.)



AQUILA CHRYSOPTERA.
(The White-tailed Eagle.)



NEOPHRON PERCNOPTERUS.
(The Egyptian Neophron.)



NAUCLERUS FURCATUS
(The Swallow-tailed Nauclerus.)



CIRCUS CINERACEUS
(The Ash-coloured Harrier.)

It lived in confinement two days, refusing to eat, and died from the effects of the wound. A few days later a boy brought me a female owl, with five eggs, that had been taken from her nest, five feet from the mouth of a burrow that wound among the roots of a tree.

"She was fierce in her cage, and fought with wings and beak, uttering all the while a shrill, prolonged note, resembling the sound produced by drawing a file across the teeth of a saw. I supplied her with eleven full-grown mice, which were devoured during the first thirty-six hours of confinement.

"I endeavored to ascertain if this species burrows its own habitation, but my observations of eight months failed to impress me with the belief that it does. I have conversed with intelligent persons who have been familiar with their habits, and never did I meet one that believed this bird to be its own laborer. It places a small nest of feathers at the end of some occupied or deserted burrow, as necessity demands, in which are deposited from two to five white eggs, which are nearly spherical in form, and are a little larger than the eggs of the domestic pigeon.

"In the Banda Oriental, where the country is as fine, and the favorite food of the owl more plentifully distributed than upon the pampas, this bird is not common in comparison with the numbers found in the latter locality. The reason is obvious. The *bizeacha* does not exist in the Banda Oriental, and consequently these birds have a poor chance for finding habitations.

"On the pampas, where thousands upon thousands of *bizeachas* undermine the soil, there, in their true locality, the traveller finds thousands of owls. Again, along the bases of the Andes, where the *bizeacha* is rarely met with, we find only a few pairs. Does the hole, from which my bird was taken, appear to be the work of a bird or quadruped? The several works that I have been able to consult do not, in one instance, give personal observations relative to the burrowing propensities of this owl; from which fact, it will be inferred that it never has been caught in the act of burrowing."

FAMILY FALCONID.E. EAGLES, HAWKS.

Of the *Circinae*, or Harrier Hawks, the Marsh Hawk of America and the Moor Harrier of Europe are good examples. The Harriers are active and constantly on the wing: they frequent healthy moors, foggy marshes, and low, flat grounds, over which they are almost continually flying. In hunting for their prey, they quarter the ground after the manner of the spaniel dog, and when they seize the object of their search (a small quadruped, bird, or reptile), they drop suddenly upon it, and clutch it in their talons. They build on the ground among ferns and rushes.

The sub-family *Falconinae* (Falcons and Hawks) is a large and interesting group. Among all the raptorial birds, none are more bold and daring

than these: they are formed for rapid flight, and pursue their prey with extreme velocity, or, soaring above, descend upon it with a swoop, bearing it to the ground. Some, as the kestrels, which feed principally on frogs and mice, not excluding insects, sail in the air, performing easy circles, hovering over one spot when discovering an object of prey, and, by a sudden and rapid descent, pouncing upon it with unmerring certainty.

Of the Falcons, the Peregrine Falcon (*Falco peregrinus*) is a well-known example.

This beautiful and once highly-valued bird is very widely spread, being found in most of the bold and rocky districts of Europe and Asia: everywhere it seems to be a bird of passage, whence its specific name, *peregrinus*. As regards the British Islands, it is common in Scotland and Wales, building on high, precipitous rocks bordering the sea-coast. It frequents similar situations in Devonshire and Cornwall, where it is called the Cliff Hawk. In many parts of Ireland it is abundant. "In the four maritime counties of Ulster," says Mr. Thompson, "it has many eyries; and in Antrim, whose basaltic precipices are favorable for this purpose, seven, at least, might be enumerated. Of these, one only is inland. At the Gobbins, regularly frequented by a pair, there were two nests in one year within an extent of rock considerably less than a mile." Of the prowess and daring of this Falcon many instances are on record. Mr. Thompson (Mag. Zoöl. and Botan., Vol. II., p. 53) observes, that "Mr. Sinclair, when on one occasion exercising his dogs on the Belfast mountains, towards the end of July, preparatory to grouse shooting, saw them point; and on coming up, he startled a male Peregrine Falcon off a grouse (*Tetrao scoticus*), just killed by him; and very near the same place he came upon the female bird, also on a grouse. Although my friend lifted both the dead birds, the hawks continued flying about, and on the remainder of the pack (of grouse), which lay near, being sprung by the dogs, either three or four more grouse were struck down by them, and thus two and a half or three brace were obtained by means of these wild birds, being more than had ever been procured out of a pack of grouse by his trained Falcons." The Peregrine Falcon attacks his prey only while on the wing, seldom pursuing it into dense cover; and it has been observed, that birds thus driven to shelter by the Peregrine Falcon are so terrified, that, rather than venture again on the wing, they will allow themselves to be captured by the hand. Even the black cock has been known to be thus taken. Mr. Thompson says the strike of this species is more fatal than its clutch, and that when flown at rooks, it has been known to strike down several birds in succession before alighting to prey on one; and he adds, "An eye-witness to the fact assures me that he once saw a falcon strike down five partridges out of a covey, one after the other; but such circum-

stances are rare. Mr. Selby, in his "British Ornithology," gives a similar instance of daring to that related by Mr. Thompson, from the account of Mr Sinclair. "In exercising my dogs upon the moors, previous to the commencement of the shooting season, I observed a large bird of the hawk genus hovering at a distance, which, upon approaching, I knew to be a Peregrine Falcon. Its attention was now drawn towards the dogs, and it accompanied them while they beat the surrounding ground. Upon their having found and sprung a brood of grouse, the Falcon immediately gave chase, and struck a young bird before they had proceeded far upon the wing. My shouts and rapid advance prevented it from securing its prey. The issue of this attempt, however, did not deter the Falcon from watching our subsequent movements; and another opportunity soon offering, it again gave chase, and struck down two birds by two rapidly-repeated blows, one of which it secured and bore off in triumph." The flight of this falcon, when pursuing its quarry, is astonishingly rapid. Montagu has reckoned it at the rate of one hundred and fifty miles an hour; and Colonel Thornton, an expert falconer, estimated the flight of one in pursuit of a snipe to have been nine in eleven minutes, without including the frequent turnings.

The Peregrine Falcon was regarded very highly in the practice of falconry; an art which, in former days, engaged the most earnest attention, and is still a common amusement among the Turks in some parts of Asia Minor, among the Persians, Circassians, and the wandering hordes of Turcomans and Tartars. "Hawking appears to have been introduced into England from the north of Europe during the fourth century. Our Saxon ancestors became passionately fond of the sport, but do not appear to have made great progress in the art of training their birds. In the eighth century, one of the kings of that race caused a letter to be written to Winnifred, Archbishop of Mons, begging the dignitary to send him some falcons that had been well trained to kill cranes. The month of October was more particularly devoted to that sport by the Saxons. We are indebted to our fierce invaders, the Danes, for many improvements in falconry. Denmark, and still more Norway, were always celebrated for their breeds of hawks, and the natives of these countries had attained an extraordinary degree of skill in the art of training them. In the eleventh century, when Canute, King of Denmark and Norway, ascended the English throne, the sport became more prevalent. We are not aware of what restrictions were imposed under the Saxon or Danish monarchs, but after the conquest by William of Normandy, none but persons of the highest rank were allowed to keep hawks. Cruel laws, with respect to field sports, were framed, and rigorously executed by the first princes of the Norman dynasty. According to the liberal views of those times, the people were held utterly unworthy of partaking anything

except the air of heaven in common with their noble oppressors. The life of a serf was of less value in the eyes of a Norman baron than that of a buck, a hound, or a hawk; and in those days, the mass of what we now call the people were serfs and slaves. As to the keeping of falcons, the great expense attending it put it entirely out of the power of the commonalty, but the prohibitive Norman law was probably meant at first to extend to such of the Saxon landholders as were rich and remained free, but had no rank nor nobility according to the conqueror's estimation. In the days of John, however, every *freeman* was most liberally permitted to have eyries of hawks, falcons, eagles, and herons in *his own woods*. In the year 1481 was printed the 'Book of St. Albans,' by Juliana Berners, sister of Lord Berners, and prioress of the nunnery of Sopewell. It consisted of two tracts, one on hawking, the other on heraldry. The noble dame obtained from her grateful contemporaries the praise of being 'a second Minerva in her studies, and another Diana in her diversions.' Her subject was well chosen; hawking was then the standing pastime of the noble, and the lady abbess treated it in the manner the most likely to please. The book became to falconers what Hoyle's has since become to whist-players; but the dame Juliana's had, moreover, the merit of paying proper homage to the jealous distinctions between man and man, as then established. According to the 'Book of St. Albans,' there was a nice adaptation of the different kinds of falcons to different ranks. Thus, such species of hawks were for kings, and could not be used by any person of inferior dignity, such for princes of the blood, such others for the duke and great lord, and so on down to the knave or servant. In all there were fifteen grades; but whether this number was so small, owing to the species of birds, or because it included all the factitious divisions of society then recognized, we cannot well determine. We have too much respect for the patience of our readers to follow the dame through all her directions, to which additions have been made in the fifteenth and seventeenth centuries. We would rather accompany the trained hawks into the field.

"Strutt, in his industrious work on the 'Sports and Pastimes of the English,' gives one or two engravings, from very old pictures, representing ladies followed by dogs, and running on foot, with their hawks on their fists, to cast them off at game. Indeed, John of Salisbury, who wrote in the thirteenth century, says that the women even excelled the men in the knowledge and practice of falconry, whence he ungallantly takes occasion to call the sport itself frivolous and effeminate. Taken altogether, however, a hunting-party of this kind, composed of knights and dames, mounted on their piaffing manège horses, and with their train of falconers, in appropriate costume, and their well-broken dogs, and the silver music of the bells, mingled with

a variety of other sounds, must have been a pleasant enough scene to behold, or to form part of."

For most species of game, it appears that spaniels, cockers, or other dogs were required to rouse the birds to wing. When the game was at a proper elevation, the hawk, being freed from his head-gear, was cast off from the sportsman's fist with a loud whoop, to encourage him. But here great science was required; and it was frequently made a matter of anxious and breathless debate as to whether the *far jetée* or the *jetée serré* should be adopted. These terms, like many more employed in those days in hawking and hunting, were derived from the French. *Jeter* signifies to throw or cast off. The *far jetée* meant to cast off the hawk at a distance from the quarry it was to pursue; and the *jetée serré* to fly it as near to the bird, or as soon after the destined prey had taken wing, as possible. But many considerations were involved in these decisions,—the species of the quarry, the peculiar properties of the hawk on hand at the time, the nature of the country, the force and direction of the wind, and numerous other circumstances had to be duly pondered.

"When the hawk was cast off, it flew in the direction of the game, and endeavored to surmount it, or get above it in its flight. To obtain this advantage, when herons and other birds strong on the wing were pursued, the hawk was obliged to have recourse to sealing, or ascending the air by performing a succession of small circles, each going higher and higher, like the steps of a winding corkscrew staircase. In whatever way it was performed, this was called 'the mount.' At times, both the pursuer and pursued would fly so high as almost to be lost in the clouds. When the hawk reached a proper elevation above the game, she shot down upon it with all her force and velocity, and this descent was technically called 'the stoop,' or 'the swoop.' John Shaw, Master of Arts, of Cambridge, who published a strange book, called '*Speculum Mundi*' (The World's Looking-glass), in that learned city, in 1635, informs us that the heron, or hernsaw, 'is a large fowle that liveth about waters, and that hath a marvellous hatred to the hawk, which hatred is duly returned. When they fight above in the air, they labor both especially for this one thing—that one may ascend and be above the other. Now if the hawk getteth the upper place, he overthroweth and vanquisheth the heron with a marvellous earnest flight.' It should seem, however, that this was not always the case, and that the heron sometimes received the hawk on its long, sharp bill, and so transfixed and killed her. When the hawk closed or grappled with her prey (which was called *binding*, in falconry), they generally tumbled down from the sky together, and the object of the sportsman was, either by running on foot or galloping his horse, to get to the spot as soon as they should touch the earth, in order to assist the

Hawk in her struggle with her prey. The falcons, it should be observed, were taken into the field with hoods over their eyes, and with little bells on their legs; and the sportsman carried a lure, to which the bird had been taught to fly, by being fed regularly upon or near it with freshly-killed meat. 'When the hawk,' says Master Gervase, 'is passingly reclaimed, you must bring her to lure by easy degrees: first, by dainties, making her jump upon your fist, then to fall upon the lure, when held out to it, and then to come at the sound of your voice; and to delight her more with the lure, have it ever garnished, on both sides, with warm and bloody meat.' These lures seem to have been of various sorts. In very old times a 'tabur-stycke,' which was merely a piece of wood rounded and besmeared with blood, was in use; but with the progress of civilization, a better lure, called a 'hawker,' was introduced. The hawker was a staff about twenty-two inches long, cased at the upper part with iron, having a bell, 'rather of sullen tone than musical,' and the figure of a bird, with outstretched wings, carved at the top. When this instrument was agitated, a reclaimed hawk would descend to it from the clouds; but, we believe, for a bird of the highest training, nothing more was required than to shake the tasselled hood in the hand of the sportsman, and to use the voice."

Of the *Asturine*, or Hawks proper, the Goshawks, so widely scattered, are well-known types. In describing the habits of the American Goshawk (*Astur atricapillus*), Audubon says,—

"The flight of the Goshawk is extremely rapid and protracted. He sweeps along the margins of the fields, through the woods, and by the edges of ponds and rivers, with such speed as to enable him to seize his prey by merely deviating a few yards from his course, assisting himself on such occasions by his long tail, which, like a rudder, he throws to the right or left, upwards or downwards, to check his progress, or enable him suddenly to alter his course. At times he passes like a meteor through the under-wood, where he secures squirrels and hares with ease. Should a flock of wild pigeons pass him when on these predatory excursions, he immediately gives chase, soon overtakes them, and, forcing his way into the very centre of the flock, scatters them in confusion, when you may see him emerging with a bird in his talons, and diving towards the depth of the forest to feed upon his victim. When travelling, he flies high, with a constant beat of the wings, seldom moving in large circles like other hawks; and, when he does this, it is only a few times in a hurried manner, after which he continues his journey.

"Along the Atlantic coast this species follows the numerous flocks of ducks that are found there during the autumn and winter, and greatly aids in the destruction of mallards, teals, black ducks, and other species, in

company with the Périgrine Falcon (*Falco anatum*). It is a restless bird, apparently more vigilant and industrious than many other hawks, and it seldom alights unless to devour its prey; nor can I recollect ever having seen one alighted, for many minutes at a time, without having a bird in its talons. When thus engaged with its prey, it stands nearly upright; and, in general, when perched, it keeps itself more erect than most species of hawks. It is extremely expert at catching snipes on the wing; and so well do these birds know their insecurity, that on its approach they prefer squatting to endeavoring to escape by flight.

"When the passenger pigeons are abundant in the western country, the Goshawk follows their close masses, and subsists upon them. A single hawk suffices to spread the greatest terror among their ranks; and the moment he sweeps towards a flock, the whole immediately dive into the deepest woods, where, notwithstanding their great speed, the marauder succeeds in clutching the fattest. While travelling along the Ohio, I observed several hawks of this species in the train of millions of these pigeons. Towards the evening of the same day, I saw one abandoning its course to give chase to a large flock of Crow Blackbirds (*Quiscalus versicolor*), then crossing the river. The hawk approached them with the swiftness of an arrow, when the blackbirds rushed together so closely, that the flock looked like a dusky ball passing through the air. On reaching the mass, he, with the greatest ease, seized first one, and then another, and another, giving each a squeeze with his talons, and suffering it to drop upon the water. In this manner he had procured four or five before the poor birds reached the woods, into which they immediately plunged, when he gave up the chase, swept over the water in graceful curves, and picked up the fruits of his industry, carrying each bird singly to the shore. Reader, is this instinct or reason?

"The nest of the Goshawk is placed on the branches of a tree, near the trunk or main stem. It is of great size, and resembles that of our crow, or some species of owl, being constructed of withered twigs and coarse grass, with a lining of fibrous strips of plants resembling hemp. It is, however, much flatter than that of the crow. In one, I found, in the month of April, three eggs, ready to be hatched: they were of a dull bluish-white, sparingly spotted with light reddish-brown. In another, which I found placed on a pine tree growing on the eastern rocky bank of the Niagara River, a few miles below the great cataract, the lining was formed of withered herbaceous plants, with a few feathers: the eggs were four in number, of a white color tinged with greenish-blue, large, much rounded, and somewhat granulated.

"In another nest were four young birds, covered with buff-colored down, their legs and feet of a pale yellowish flesh-color, the bill light blue, and the eyes pale gray. They differed greatly in size, one being quite small com-

pared with the rest. I am of opinion that few breed to the south of the State of Maine."

We once witnessed an attempt of this bird to capture a common gray squirrel, that was quite interesting to the beholder, but certainly not to the animal. While on a collecting excursion, a few miles from Boston, as we were seated beneath a huge oak, observing the movements of some small birds, we heard the barking of a squirrel; and, while looking for his whereabouts, we suddenly heard a whistling sound as of a body falling through the air, and, as quick as thought, a Goshawk struck on the limb, on the spot where, a second before, the squirrel had been seated: luckily for the squirrel, the hawk missed his aim, the animal giving a sudden dodge beneath the limb the moment the hawk appeared. All who are acquainted with the habits of this quadruped know that it is very successful in dodging behind the limb of a tree, and hugging it closely. The hawk sat a few moments, apparently surprised at his disappointment, when, suddenly launching into the air, he espied it beneath the limb, hugging for dear life. As soon as he had moved, the squirrel turned adroitly on the limb, still keeping it between itself and its enemy. After several trials, the hawk, always alighting and remaining perched on the limb a few seconds, succeeded, by a dexterous feint, in securing his prey, when, on the instant, we fired, bringing the hawk and his victim to the ground. The hawk dropped dead; but the squirrel, after lying on the ground a moment, got up, and staggered off beneath a pile of rocks, and we neither saw nor heard anything more of it.

Of the *Gypogeraninae*, the Secretary Buzzard is the type. This singular bird is termed, in allusion to its habits, *Slangen-vreeter*, or Serpent-eater, by the Dutch colonists of the Cape, and its Hottentot name has the same meaning; snakes, in fact, constitute its principal food, and, in the attack and defence, it displays the greatest coolness and address.

"The Slangen-vreeter," says Sparrman, "has a peculiar method of seizing upon serpents. When it approaches them, it always takes care to hold the point of one of its wings before it, in order to parry off their venomous bites: sometimes it finds an opportunity of spurning and treading upon its antagonist, or else, of taking it up on its pinions, and throwing it into the air. When, by this method of proceeding, it has at length wearied out its adversary, and rendered it almost senseless, it then kills it, and swallows it without danger. Though I have very frequently seen the Secretary Bird, both in its wild and tame state, yet I have never had an opportunity of seeing this method it has of catching serpents; however, I can by no means harbor any doubt concerning it, after having had it confirmed to me by so many Hottentots as well as Christians, and since this bird has been observed at the menagerie at the Hague to amuse and exercise itself in the same

manner with a straw." The Secretary was so called by the Dutch from the plumes at the back of its head, which reminded them of the pen stuck behind the ear, according to the custom of the *gens de cabinet* in Holland, and the name has since been generally adopted. These birds, at least in South Africa, are not gregarious, but live in pairs, and build on high trees, or in dense thickets. Their gait is a singular stalk, reminding us of a person moving along on elevated stilts; but they run with great swiftness, and are not to be approached, without great difficulty, by the sportsman. Attempts have been made (how far successful we know not) to introduce this bird into Martinique for the purpose of destroying the deadly lance-headed viper, or yellow serpent, of the Antilles (*Trigonocephalus lanceolatus*), which abounds there, and is greatly dreaded.

The type of the sub-family *Perninae*, the Honey Buzzard (*Pernis apivorus*), is very rare in England, but more common in the warmer countries of Europe, where it is migratory. It is found in Asia, and specimens have been received from various parts of India. We believe one instance, only, of its having been killed in Ireland, is on record. The bird in question was shot by R. G. Bornford, Esq., in his demesne of Annandale, near Belfast. Mr. Thompson states that the bill and forehead were covered with cow-dung, from the search the bird had evidently been making for insects. The stomach contained some of the larvæ, and fragments of coleoptera, and various caterpillars. It is, in fact, chiefly upon caterpillars and the larvæ of bees and wasps that the Honey Buzzard feeds, together with other insects, not, however, to the exclusion of moles, mice, rats, small birds, reptiles, and slugs.

According to Vieillot, the Honey Buzzard flies low, but runs on the ground with great celerity. It breeds in tall trees, making a nest of twigs, with an inner layer of wool: the eggs are two or three in number, of an ashy gray, dotted at each end with small, red spots, and surrounded, in the middle, with a broad, blood-red zone, or mottled all over with two shades of orange brown.

Of the *Milvine*, the Swallow-tailed Hawk (*Nauclerus furcatus*) of America, and the Kite (*Milvus ictinus*) of Europe and Asia, are examples.

The Swallow-tailed Hawk, remarkable for its grace and ease on the wing, is described by Audubon as follows:—

"In the States of Louisiana and Mississippi, where these birds are abundant, they arrive in large companies in the beginning of April, and are heard uttering a sharp, plaintive note. At this period, I generally remarked that they came from the westward, and have counted upwards of a hundred in the space of an hour, passing over me in a direct easterly course. At that season, and in the beginning of September, when they all retire

from the United States, they are easily approached when they have alighted, being then apparently fatigued, and busily engaged in preparing themselves for continuing their journey, by dressing and oiling their feathers. At all other times, however, it is extremely difficult to get near them, as they are generally on the wing through the day, and at night rest on the higher pines and cypresses bordering the river bluffs, the lakes, or the swamps of that district of country. They always feed on the wing. In calm and warm weather they soar to an immense height, pursuing the large insects called Mosquito Hawks, and performing the most singular evolutions that can be conceived, using their tail with an elegance of motion peculiar to themselves. Their principal food, however, is large grasshoppers, grass-caterpillars, small snakes, lizards, and frogs. They sweep close over the fields, sometimes seeming to alight for a moment to secure a snake, and, holding it fast by the neck, carry it off, and devour it in the air. When searching for grasshoppers and caterpillars, it is not difficult to approach under cover of a fence or tree. When one of them is killed and falls to the ground, the whole flock come over the dead bird, as if intent upon carrying it off. An excellent opportunity is thus afforded of shooting as many as may be wanted, and I have killed several of these hawks in this manner, firing as fast as I could load my gun. The Swallow-tailed Hawk pairs immediately after its arrival in the Southern States; and as its courtships take place on the wing, its motions are then more beautiful than ever. The nest is usually placed on the top branches of the tallest oak or pine tree, situated on the margin of a stream or pond. It resembles that of a carion crow externally, being formed of dry sticks, intermixed with Spanish moss, and is lined with coarse grasses and a few feathers. The eggs are from four to six, of a greenish-white color, with a few irregular blotches of dark brown at the large end. The male and female sit alternately, the one feeding the other. The young are at first covered with buff-colored down. Their nest covering exhibits the pure white and black of the old birds, but without any of the glossy-purplish tints of the latter. The tail, which at first is but slightly forked, becomes more so in a few weeks, and at the approach of autumn exhibits little difference from that of the adult birds. The plumage is completed the first spring. Only one brood is raised in the season. The species leaves the United States in the beginning of September, moving off in flocks, which are formed immediately after the breeding season is over."

The Kite is distributed over the greatest part of Europe and Asia, and the northern districts of Africa. In the British islands it appears to be less common than formerly: in Ireland it is not known. Formerly it was very abundant in the southern counties of England, and Clusius states, that when he was in London an amazing number of Kites flocked there for the

offal thrown into the streets : they were so tame that they took their prey in the midst of crowds, and it was forbidden to kill them.

"The Kite," says Mr. Selby, "is proverbial for the ease and gracefulness of its flight, which consists of long, sweeping circles, performed with a motionless wing, or, at least, with a slight and almost imperceptible stroke of its pinions, and at very distant intervals. In this manner, and directing its course by the aid of the tail, which acts as a rudder, its slightest motion producing an effect, it frequently soars to such a height as to become almost invisible to the human eye." Its appearance, as it wheels over the farm-yard, with eyes intent upon the broods of chickens and ducklings, is by no means hailed with pleasure, either by the feathered dependants of the farm, or the good man who owns them. The poultry set up loud cries of execration ; the hens call their broods beneath their wings, and chanticleer prepares for battle ; the dogs are roused, and the men run for their guns. Finding preparations made to receive him, the marauder generally makes off ; but if he has swept away a chicken before the alarm is given, he is almost sure of repeating his visit, and is oftentimes so successful as to destroy a whole brood. Leverets, rabbits, young game, and small mammalia are also the prey of this species : it has been known to skim off dead fish and other floating animal substances from the surface of the water with the greatest address. The Kite builds its nest in the forked branch of some tall forest tree, and constructs it of sticks and twigs, lining it with wool, hair, and other soft materials. The eggs are three in number, rather larger than those of a hen : they are of a dirty white, with reddish-brown spots at the large end. The female defends her nest vigorously.

Of the *Aquilinae*, the White-headed Eagle, or Bald Eagle, as it is improperly called, the Golden Eagle, and the Great Harpy Eagle furnish prominent examples.

The White-headed Eagle is found in nearly all portions of temperate North America, from whence it is a very rare wanderer in Europe. Wilson's account of the bird and its habits is one of the most interesting passages in ornithological literature.

"The celebrated cataract of Niagara," he says, "is a noted resort for the Bald Eagle, as well on account of the fish procured there, as for the numerous carcasses of squirrels, deer, bears, and other various animals, that, in their attempts to cross the river above the falls, have been dragged into the current, and precipitated down that tremendous gulf, where, among the rocks that bound the rapids below, they furnish a rich repast for the vulture, the raven, and the subject of the present account.

"Formed by nature for bearing the severest cold, feeding equally on the produce of the sea and of the land, possessing powers of flight capable of

outstripping even the tempests themselves, unawed by anything but man, and from the ethereal heights to which he soars, looking abroad at one glance over an immeasurable expanse of forests, fields, lakes, and ocean deep below him, he appears indifferent to the change of seasons, as, in a few minutes, he can pass from summer to winter, from the lower to the higher regions of the atmosphere (the abode of eternal cold), and thence descend at will to the torrid or to the arctic regions of the earth. He is, therefore, found at all seasons in the countries he inhabits, but prefers such places as have been mentioned above, from the great partiality he has for fish." "In procuring these, he displays, in a very singular manner, the genius and energy of his character, which is fierce, contemplative, daring, and tyrannical — attributes not exerted but on particular occasions, but, when put forth, overpowering all opposition. Elevated on the high, dead limb of some gigantic tree, that commands a wide view of the neighboring shore and ocean, he seems calmly to contemplate the motions of the various feathered tribes that pursue their busy avocations below — the snow-white gulls slowly winnowing the air, the busy *tringae* coursing along the sands, silent and watchful cranes intent and wading, clamorous crows, and all the winged multitudes that subsist by the bounty of this vast magazine of nature. High over all these hovers one, whose action instantly arrests his whole attention. By his wide curvature of wing, and sudden suspension in air, he knows him to be the fish-hawk, settling over some devoted victim of the deep. His eye kindles at the sight, and, balancing himself with half-opened wings on the branch, he awaits the result. Down, rapid as an arrow, from heaven descends the distant object of his attention, the roar of its wings reaching the ear as it disappears in the deep, making the surges foam around. At this moment the eager looks of the eagle are all ardor; and, levelling his neck for flight, he sees the fish-hawk once more emerge, struggling with his prey, and mounting in the air with screams of exultation. These are the signal for the eagle, who, launching into the air, instantly gives chase, and soon gains on the fish-hawk. Each exerts his utmost to mount above the other, displaying in these rencontres the most elegant and sublime aerial evolutions. The unencumbered eagle rapidly advances, and is just on the point of reaching his opponent, when, with a sudden scream, probably of despair and honest execration, the latter drops his fish: the Eagle, poising himself for a moment, as if to take a more certain aim, descends like a whirlwind, snatches it in his grasp ere it reaches the water, and bears his ill-gotten booty silently away to the woods."

This is not the only mode in which the White-headed Eagle procures his sustenance. Young lambs and pigs, ducks, geese, swans, and various sea-fowl, are attacked and carried away. Mr. J. Gardiner stated to Wilson,

that he saw one flying with a lamb ten days old, but which, from the violence of its struggles, it was obliged to drop at the height of a few feet from the ground. He added that, by running up and hallooing, he prevented it from again seizing the lamb, whose back it had broken, and to whose misery he put an instant termination. The dam seemed astonished to see its offspring suddenly snatched up and borne off by a bird. Sheep, if old or sickly, are also subject to the attacks of these tyrants of the feathered race; nor do they reject carrion, keeping the vultures (over which they often exercise their despotism) at a respectful distance, waiting till they have gorged their fill and departed. Now and then they procure fish for themselves in shallow places, wading in the water, and striking at them with their beak. They have been known even to attack children. We have quoted Wilson's animated description of the attack of the White-headed Eagle upon the fish-hawk or osprey; and we will now transcribe Audubon's equally graphic details of a different conflict: —

"To give you," he writes, "some idea of the nature of this bird, permit me to place you on the Mississippi, on which you may float gently along, while approaching winter brings millions of water-fowls, on whistling wings, from the countries of the north, to seek a milder climate in which to sojourn for a season. The eagle is seen perched, in an erect attitude, on the summit of the tallest tree by the margin of the broad stream. His glistening but stern eye looks over the vast expanse; he listens attentively to every sound that comes to his quick ear from afar, glancing every now and then on the earth beneath, lest even the light tread of the fawn may pass unheard. His mate is perched on the opposite side, and, should all be tranquil and silent, warns him by a cry to continue patient. At this well-known call, he partly opens his broad wings, inclines his body a little downwards, and answers to her voice in tones not unlike the laugh of a maniac. The next moment he resumes his erect attitude, and again all around is silent. Ducks of many species — the teal, the widgeon, the mallard, and others — are seen passing with great rapidity, and following the course of the current, but the eagle heeds them not; they are at that time beneath his attention. The next moment, however, the wild, trumpet-like sound of a yet distant but approaching swan is heard. A shriek from the female eagle comes across the stream, for she is fully as alert as her mate. The latter suddenly shakes the whole of his body, and, with a few touches of his bill, aided by the action of his cuticular muscles, arranges his plumes in an instant. The snow-white bird is now in sight; her long neck is stretched forward; her eye is on the watch, vigilant as that of her enemy; her large wings seem with difficulty to support the weight of her body, although they flap incessantly; so irksome do her exertions seem, that her very legs are

spread beneath her tail to aid her in her flight. She approaches, however. The eagle has marked her for his prey. As the swan is passing the dreaded pair, starts from his perch the male bird in preparation for the chase, with an awful scream, that, to the swan's ear, brings more terror than the report of the large duck-gun. Now is the moment to witness the display of the eagle's powers. He glides through the air like a falling star, and, like a flash of lightning, comes upon the timorous quarry, which now, in agony and despair, seeks by various manoeuvres to elude the grasp of his cruel talons. It mounts, doubles, and willingly would plunge into the stream were it not prevented by the eagle, which, possessed of the knowledge that by such a stratagem the swan might escape him, forces it to remain in the air by attempting to strike it with his talons from beneath. The hope of escape is soon given up by the swan. It has already become much weakened, and its strength fails at the sight of the courage and swiftness of its antagonist. Its last gasp is about to escape, when the ferocious eagle strikes with its talons the under side of its wing, and, with unresisted power, forces the bird to fall, in a slanting direction, upon the nearest shore. It is then that you may see the cruel spirit of this dreaded enemy of the feathered race, whilst exulting over his prey he for the first time breathes with ease. He presses down his powerful feet, and drives his sharp claws deep into the heart of the dying bird; he shrieks with delight as he feels the last convulsions of his prey, which has now sunk under his efforts to render death as painful as it possibly can be. The female has watched every movement of her mate; and if she did not assist him in capturing the swan, it was not from want of will, but merely that she felt full assurance that the power and courage of her lord were quite sufficient for the deed. She now sails to the spot where he eagerly awaits her; and when she has arrived, they together turn the breast of the luckless swan upwards, and gorge themselves with gore."

The White-headed Eagle is seldom seen alone, but generally in company with its mate; the union continues during life; they hunt for the support of each other, and feed together. The nest is usually placed on some tall tree, with a massive, towering stem, destitute of branches for a considerable height. It is composed of sticks, clods, weeds, and moss, and measures five or six feet in diameter; and, being annually augmented by fresh layers (for it is used year after year), it is often as much in depth. The eggs are from two to four in number, and of a dull white. The attachment of the parents to their young is very great; and they provide abundantly for their support, bringing home fish, squirrels, young lambs, opossums, raccoons, &c.

The Harpy Eagle (*Harpyia destructor*) is a native of Guiana, and other parts of South America, where it frequents the deep recesses of the

forests remote from the abodes of man. Of its habits, however, in a state of nature, we have but little information. It is feared for its great strength and fierceness, and is reported not to hesitate in attacking individuals of the human race; nay, that instances have been known in which persons have fallen a sacrifice, their skulls having been fractured by the blows of its beak and talons. This may be an exaggeration, but certainly it would be a hazardous experiment to venture unarmed near the nest of a pair of these formidable eagles. Hernandez states that this species not only ventures to assault man, but even beasts of prey. According to Mendruyt, it makes great destruction among the sloths, which tenant the branches of the forest, and are ill fitted to resist so formidable an antagonist: it also destroys fawns, cayies, opossums, and other quadrupeds, which it carries to its lonely retreat, there, in solitude, to satiate its appetite. Monkeys are also to be numbered among its victims; but the sloth is said to constitute its ordinary prey. Of its nidification we know nothing; as the eagles, however, lay only from two to three eggs, it is reasonable to suppose that the present species is not an exception to the rule.

It has been correctly observed by Mr. Selby, that the members of the Aquiline division of the raptorial order do not possess the same facility of pursuing their prey upon the wing which we see in the falcons and hawks; for, though their flight is very powerful, they are not capable of the rapid evolutions that attend the aerial attacks of the above-named groups, in consequence of which their prey is mostly pounced upon on the ground. The shortness of the wings of the Harpy Eagle, when compared with those of the Golden Eagle of Europe, and their rounded form and breadth, though well adapting them for a continued and steady flight, render them less efficient as organs of rapid and sudden aerial evolutions than those of the latter; but, as it inhabits the woods, and does not prey upon birds but upon animals incapable of saving themselves by flight, its powers of wing (or rather the modification of those powers) are in accordance with the circumstances as to food and locality under which it is placed. If the Harpy Eagle soars not aloft, hovering over plains and mountains, it threads the woods, it skims amidst the trees, and marks the sloth suspended on the branch, or the monkey dozing in unsuspecting security; and, with unerring aim, strikes its defenceless victims. Mr. Selby, commenting on the fierceness of a pair of Golden Eagles in his possession, and their readiness to attack every one indiscriminately, observes, that when living prey (as hares, rabbits, or cats) are thrown to them, the animal is "instantly pounced on by a stroke behind the head, and another about the region of the heart, the bill appearing never to be used but for the purpose of tearing up the prey when dead." It is precisely in this manner that the Harpy Eagle deals with

its victims ; death seems the work of an instant ; the strongest eat, powerless in his grasp, is clutched, and expires. Nor will this surprise any one who has contemplated the power seated in the talons of this bird : strong as are the talons of the Golden Eagle, great as is the muscular development of its limbs, and formidable as are its claws, they seem almost trifling compared with those of the Harpy Eagle. " In the Museum of the Zoölogical Society are the skeletons of both these birds, which it is interesting to compare together. The thickness of the bones of the limbs in the latter, and especially of the tarsus, which is more than double that of the Golden Eagle, and the enormous size of the talons, are sufficient to convince the observer of the ease with which, when living, the fierce bird would bury its sharp-hooked claws in the vitals of its prey, and how vain resistance when the fatal grasp was taken. In its native regions, the Harpy Eagle is said to be by no means common : were it so, the destruction occasioned by its presence would, it might be naturally expected, preponderate over the renovation of the species which constitute its habitual food, and the balance which Nature has established between the destroyed and the destroying, the sanguinary and their victims, be thus disarranged. No doubt that (as is the case with all carnivorous animals) its numerical ratio, in a given space, is proportionate to that of the animals on which it is destined habitually to feed. Where the sloth is most abundant, there will most abound the Harpy Eagle."

The *Pandioninae*, or Ospreys, are well known. The American species very closely resembles the European and Asiatic in characteristics of form and habit.

Audubon, whose descriptions of the habits of American birds are always most interesting, says of the Osprey as follows : —

" As soon as the females make their appearance, which happens eight or ten days after the arrival of the males, the love season commences, and, soon after, incubation takes place. The loves of these birds are conducted in a different way from those of the other falcons. The males are seen playing through the air amongst themselves, chasing each other in sport, or sailing by the side of, or after, the female which they have selected, uttering cries of joy and exultation, alighting on the branches of the tree on which their last year's nest is yet seen remaining, and, doubtless, congratulating each other on finding their home again. Their caresses are mutual. They begin to augment their habitation, or to repair the injuries which it may have sustained during the winter, and are seen sailing together towards the shores, to collect the drifted sea-weeds, with which they line the nest anew. They alight on the beach, search for the dryest and largest weeds, collect a mass of them, clinch them in their talons, and fly towards their nest, with the

materials dangling beneath. They both alight and labor together. In a fortnight the nest is complete, and the female deposits her eggs."

The nest is generally placed in a large tree in the immediate vicinity of the water, either along the sea-shore, on the margins of the inland lakes, or by some large river. It is, however, sometimes to be seen in the interior of a wood, a mile or more from the water. We have concluded that, in the latter case, it was on account of frequent disturbance, or attempts at destruction, that the birds had removed from their usual haunts. The nest is very large, sometimes measuring fully four feet across, and is composed of a quantity of materials sufficient to render its depth equal to its diameter. Large sticks, mixed with sea-weeds, tufts of strong grass, and other materials, form its exterior, while the interior is composed of sea-weeds and finer grasses. We have not observed that any particular species of tree is preferred by the Fish-Hawk. It places its nest in the fork of an oak or a pine with equal pleasure. But we have observed that the tree chosen is usually of considerable size, and not unfrequently a decayed one.

The Fish-Hawk is gregarious, and often breeds in colonies of three or four nests in an area of a few acres. The males assist in incubation.

We have heard of instances of as many as a dozen nests being found in the distance of half a mile on the coast of New Jersey.

In New England the species is not so plentiful, and seldom more than one nest can be found in one locality. The flight of the bird is strong, vigorous, and well sustained. As he flies over the ocean, at a height of perhaps fifty feet, his long wings, as they beat the air in quick, sharp strokes, give the bird the appearance of being much larger than he really is. When he plunges into the water, he invariably seizes the fish (his prey) in his talons, and is sometimes immersed to the depth of a foot or eighteen inches in his efforts to capture it. He is of a peaceable disposition, and never molests any of his feathered neighbors. If the nest is plundered, the parent attacks the intruder, and often inflicts ugly wounds in its defence.

The eggs are usually laid before the 10th of May: they are generally three in number. They vary considerably, both in shape, size, and markings. In a majority of specimens the ground color is a rich reddish-cream, and covered with numerous blotches of different shades of brown. In a number of specimens these blotches are confluent, and the primary color is nearly hidden. Their form varies from nearly spherical to ovoidal, and the dimensions from 2.28 to 2.44 inches in length, and from 1.65 to 1.83 in breadth.

The *Polyborinae*, of which the *Caracara Eagle* (*Polyborus tharos*) is the type, are "common throughout South America, being found from the shores of the Gulf of Mexico as far as Cape Horn. Their flight is slow and

heavy, and they seldom soar in the air. They run, however, rather quickly along the ground, waiting their share of the carcass, on which the turkey-buzzards have commenced their feast. It is in the neighborhood of the slaughtering-houses on the River Plata that they are most common, where they feed on the offal of the animals killed. Worms and insects also form a portion of their food; and further, they are stated to attack young lambs and birds in small parties."

FAMILY VULTURIDÆ. VULTURES AND CONDORS.

The sub-families of this group, as characterized on a preceding page, are distributed in both Worlds, and are well known. Our limits will permit a consideration of but two of the most interesting species.

The Condor (*Sarcoramphus gryphus*) is one of the largest of the feathered tribe. It is found among the Andes of South America, to which locality it seems restricted.

The elevation chosen by the Condor as its breeding-place and habitual residence, varies from ten thousand feet to fifteen thousand above the level of the sea; and here, on some isolated pinnacle or jutting ledge, it rears its brood, and looks down upon the plains below for food. It is generally seen singly or in pairs, seldom in large companies; though, among the basaltic cliffs of the St. Cruz, Mr. Darwin found a spot where scores usually haunt. "On coming," he says, "to the brow of the precipice, it was a fine sight to see between twenty and thirty of these great birds start heavily from their resting-places, and wheel away in majestic circles." It appears that many clusters of rocks, or high, precipitous crags, are named after these birds: the appellations, in the language of the Incas, meaning the "Condor's lookout," the "Condor's roost," the "Condor's nest," &c.

High over the loftiest pinnacles may the Condor often be seen soaring, borne up on outspread wings, describing, in its flight, the most graceful spires and circles. "Except when rising from the ground," says Mr. Darwin, "I do not recollect ever having seen one of these birds flap his wings. Near Lima, I watched several for nearly half an hour, without once taking off my eyes. They move in large curves, sweeping in circles, descending and ascending, without once flapping. As they glided close over my head, I intently watched, from an oblique position, the outlines of the separate and terminal feathers of the wing: if there had been the least vibratory movement, these would have blended together; but they were seen distinct against the blue sky. The head and neck were moved frequently, and apparently with force; and it appeared as if the extended wings formed the fulcrum on which the movements of the neck, body, and tail acted. If the bird wished to descend, the wings were for a moment collapsed; and then, when again

expanded, with an altered inclination, the momentum gained by the rapid descent seemed to urge the bird upwards with the even and steady movement of a paper kite. In case of any bird soaring, its motion must be sufficiently rapid, so that the action of the inclined surface of its body on the atmosphere may counterbalance its gravity. The force to keep up the momentum of a body moving in a horizontal plane in that fluid (in which there is so little friction) cannot be great, and this force is all that is wanted. The movement of the neck and body of the Condor we must suppose sufficient for this. However this may be, it is truly wonderful and beautiful to see so great a bird, hour after hour, without any apparent exertion, wheeling and gliding over mountain and river."

The Condor feeds, like other vultures, on carrion, dead llamas, mules, sheep, &c. When gorged with food, they sit sullen and drowsy on the rocks, and, as Humboldt says, will suffer themselves to be driven before the hunters, rather than take wing; but he adds, that he has seen them when on the look-out for prey, especially on severe days, soaring at a prodigious height, as if for the purpose of commanding the most extensive view. The same writer states that he never heard of any well-authenticated instance of these birds carrying away children (according to vague report); that he often approached within a few feet of them, as they sat on the rocks, but they never manifested any disposition to assault him; and the Indians at Quito assure him that men have nothing to fear from them. This scarcely applies to other animals. "Besides feeding on carrion," says Mr. Darwin, "the Condors will frequently attack young goats and lambs. Hence the shepherd-dogs are trained, the moment the enemy passes over, to run out, and, looking upwards, to bark violently." Two of them will sometimes attack the vicugna, the llama, the heifer, and even the puma, persecuting the quadruped till it falls beneath the wounds inflicted by the beaks of its assailants. The Condor is, indeed, amazingly strong, and extremely tenacious of life. Sir Francis Head relates the account of a struggle between one of his Cornish miners and a Condor gorged with food, and, therefore, not in the best state for the fray: the man began by grasping the bird round the neck, which he tried to break; but the bird, roused by the unceremonious attack, struggled so violently as to defeat the plan; nor, after an hour's struggling, though the miner brought away several of the wing feathers in token of victory, does it appear that the bird was despatched.

According to Mr. Darwin (and Humboldt states the same), "the Condor makes no sort of nest, but in the months of November and December lays two large white eggs on a shelf of bare rock. On the Patagonian coast, I could not see any sort of nest among the cliffs where the young were standing. It is said that young Condors cannot fly for an entire year. At

Concepcion, on the 5th of March (corresponding to our September), I saw a young bird, which, though in size little inferior to an old one, was completely covered with down, like that of a gosling, but of a blackish color. After the period when the young Condors can fly, and apparently as well as the old birds, they yet remain at night on the same ledge, hunting by day with their parents. Before, however, the young bird has the ruff turned white, it may be often seen hunting by itself." Mr. Darwin considers it probable that the Condor breeds only once in two years.

The King Vulture (*Sarcoramphus papa*) is a native of the intertropical regions of America, and is seen occasionally in Florida—probably its most northern limit. It is not, like the Condor, a mountain bird, but tenants the low, humid forests bordering rivers and savannas, where animal life is abundant, and where decomposition rapidly succeeds death. It is amidst the most luxuriant scenery that this monarch of the vultures reigns, the turkey-buzzard and gallinazo being in subjection under him. Waterton, in his entertaining work, relates that, while sailing up Essequibo, he observed a pair of King Vultures sitting on the naked branch of a tree, with about a dozen of the common species, waiting to begin the feast upon a goat killed by a jaguar, but which he had been forced to abandon. The pair seemed rather to tolerate the presence of the rest, than to associate with them on the terms of familiarity. The same traveller, having killed a large serpent, caused it to be carried into the forest, as a lure for one of these vultures which he wished to obtain. He watched the result. "The foliage," he says, where he laid the snake, "was impervious to the sun's rays; and had any vultures passed over that part of the forest, I think I may say, with safety, that they would not have seen the body through the shade. For the first two days not a vulture made its appearance at the spot, though I could see a *Vultur aura*, gliding on apparently immovable pinions, at a moderate height over the tops of the forest trees; but, during the afternoon of the same day, when the carcass of the serpent had got into a state of putrefaction, more than twenty of the common vultures came and perched upon the neighboring trees, and the next morning, a little before six o'clock, I saw a magnificent King of the Vultures. There was a stupendous moro tree close by, whose topmost branches had either been tried by time, or blasted by the thunder-storm. Upon this branch I killed the King of the Vultures before it had descended to partake of the savory food which had attracted it to the place. Soon after this, another King of the Vultures came, and, after he had stuflled himself almost to suffocation, the rest pounced down upon the remains of the serpent, and staid there till they had devoured the last morsel."

Though this species is mostly seen alone or in pairs, travellers state that,

in Mexico, it is sometimes observed in flocks. The general account,—that the other vultures stand patiently by till their monarch has finished his repast,—and which appears to be not without foundation, may be easily accounted for by the superior strength and courage of this species.

The *Gypaëtine*, or Bearded Vultures, are comprehended in a single species, viz., the *Gypaëtus barbatus*, often called the *Lämmmergeyer*.

This bird is found throughout the whole of the great mountain chains of the Old World. It occurs in the Pyrenees, and in the Alps of Germany and Switzerland, where it is notorious for its destructiveness among the lambs and kids which are fed on the green slopes of the lower ranges. The intermediate situation assigned to the Lämmmergeyer, and which is aptly expressed in the generic appellation *Gypaëtus*, is clearly indicated in its form and general habits. Of a powerful and robust make, it has neither the bill nor the talons of the eagle, the former being elongated, and hooked only at the tip, and the latter comparatively small; yet it prefers to prey on victims which it has itself destroyed, or upon the flesh of animals recently slaughtered, and, unless hard pressed by hunger, rejects putrid carion, the favorite repast of the vulture. The eagle bears off his prey; the Lämmmergeyer, unless disturbed, or providing for its young, seldom attempts to remove it, but devours it on the spot. Attracted by the carcass of some unfortunate animal, which has recently perished among the ravines of the mountains, a number of these birds gradually congregate to share the booty, and gorge, like the vulture, to repletion. The Lämmmergeyer attacks hares, lambs, kids, and the weak and sickly of the flocks, with great ferocity: the strong-limbed chamois is not secure, nor, when rendered desperate by hunger, will the ravenous bird forbear an attack on man. Children, indeed, are said to have often fallen sacrifices to its rapacity. Young or small animals are easily destroyed, for, though elongated, the beak is hard and strong, and well adapted for lacerating the victim; but larger animals, instead of being at once grappled with, are, as it is said, insidiously assaulted while upon the edge of some precipice or steep declivity, the bird unexpectedly sweeping upon them with fury, and hurrying them into the abyss, down which it plunges to glut its appetite. As illustrative of the boldness of the Lämmmergeyer, Bruce relates that, attracted by the preparations for dinner, which his servants were making on the summit of a lofty mountain, a Bearded Vulture "slowly made his advances to the party, and at length fairly seated himself within the ring they had formed. The affrighted natives ran for their lances and shields, and the bird, after an ineffectual attempt to abstract a portion of their meat from the boiling water, seized a large piece in each of his talons, from a platter that stood by, and carried them off slowly along the ground as he came." Returning for a second freight, he was shot.

On page 358, Vol. I., we presented a table of the primary groups of birds, with their characters. These groups, of course, contain a very great variety of forms, comprehended in numerous sub-divisions, or families.

CHIMACTERISTICS OF EMMELLES

These families are again divided into sub-families, by well marked characters, which are given on the following page:—

STUDIES OF THE WILL,

SYNOPSIS OF SUB-FAMILIES.

ORDER PULLASTRIÆ.

In this order are included the *Didunculidæ*, or Dodos (birds now extinct); the *Columbidæ*, or Pigeons; the *Penelopidæ*, or *Cracidæ*, Curaçows, of Gray, and the *Megapodidæ*, the Megapodes, or Mound Birds. Our present limits will permit but a brief view of these families, and the others not yet treated of.

FAMILY DIDUNCULIDÆ. THE DODOS.

Of the existence of the Dodo in the sixteenth and seventeenth centuries, there is abundant evidence. Its *habitat* was the Island of Mauritius: it is described as being as large as our swans, with a large head, and a kind of hood thereon; "no wings, but, in place of them, three or four black little pens, and the tail consisting of four or five plumelets of a grayish color." In Willoughby's translation of Clusius is the following:—

"This exotic bird, found by the Hollanders on the Mauritius Island, did equal or exceed a swan in bigness, but was of a far different shape; for its head was great, covered, as it were, with a certain membrane resembling a hood; besides, its bill was not flat and broad, but thick and long, of a yellowish color next the head, the point being black. The upper chap was hooked, in the nether was a bluish spot in the middle, between the yellow and black part. Its legs were thick, rather than long, whose upper part, as far as the knee, was covered with black feathers."

Bontius, edited by Piso (1658), says,—

"It hath yellow legs, thick, but very short; four toes in each foot, solid, long, as it were, scaly, armed with strong, black claws. It is a slow-paeed and stupid bird, and which easily becomes a prey to the fowlers. The flesh, especially of the breast, is fat, esculent, and so copious, that three or four Dodos will sometimes suffice to fill an hundred seamen's bellies."

Of the information concerning these birds accessible, the above seems the most interesting. The species is now completely extirpated, and a skull and foot, with a few old paintings in the British Museum, are all there is left to show that it ever existed.

FAMILY COLUMBIDÆ. PIGEONS AND DOVES.

Vieillot conformed to the opinion of Linnaeus in placing these birds among the Passeres, because of their natural great analogy to that group, like nearly the whole of which, the Pigeons pair in the season of love, the male and female working jointly at the nest, taking their turns during incubation,

PIGEONS.



POUTER.

CRESTED.



ARCHANGEI

SUABIAN

and participating in the care of the young, which, among the true Pigeons, are hatched blind, fed in the nest, which they do not quit until they are covered with feathers, and are supported by their parents some time after their departure from it, having no power to feed themselves. Such are the points of resemblance. Their dissimilarity consists in their mode of drinking, and feeding their young, in the nature of their plumage, and the singularity of their courtship, and of their voice — points of difference which also separate them from the true gallinaceous birds, "with which," says M. Vieillot, "they have no analogy in their instincts, their habits, or their loves. Nearly all the gallinaceous birds are polygamous, and lay a great number of eggs each time they incubate, which is rarely more than once a year in the temperate zones; while the true Pigeons lay only two eggs each time, incubate frequently during the year, and are monogamous. Among the gallinaceous birds, as a general rule, the male does not solace the female at the time of building the nest and of incubation: the young run as soon almost as they are out of the egg-shell, quitting their nest, and seeking their own food immediately."

The Pigeons occupy a peculiar position, and no birds are so nearly allied that their points of separation are not plainly manifest.

One peculiarity of their internal organization is worthy a special notice. The crop, in the state which is adapted for ordinary digestion, is thin and membranous, and the internal surface is smooth; but, by the time the young are about to be hatched, the whole, except the part which lies on the trachea, becomes thicker, and puts on a glandular appearance, having its internal surface very irregular. It is in this organ that the food is elaborated by the parents before it is conveyed to the young; for a milky fluid of a grayish color is secreted and poured into the crop among the grain or seeds undergoing digestion, and a quality of food suited to the nestling is thus produced. The fluid coagulates with acids, and forms curd, and the apparatus forms among birds the nearest approach to the mammae of quadrupeds. The distribution of this family is very extensive, the form occurring almost everywhere, except within the frigid zones. Among their numbers are found some of the most gorgeously-attired birds, and some have, such as the Turtle Dove, the Carrier Dove, the Passenger Pigeon, a history as familiar as that of the most common species. Of these birds, the Wild Pigeon, or Passenger Pigeon of America, is one of the most interesting. This singular bird inhabits a wide and extensive region of North America, though it does not seem to be known westward of the Great Rocky Mountains, but spreads all over Canada, and ranges as far south as the Gulf of Mexico.

The numbers of these birds which associate in their breeding-places almost surpass belief: these breeding-places are always in the woods, and some-

times occupy a large extent of forest. "When they have frequented," says Wilson, "one of these places for some time, the appearance it exhibits is surprising. The ground is covered to the depth of several inches with their dung; all the tender grass and underwood destroyed; the surface strewed with large limbs of trees, broken down by the weight of the birds clustering one above another; and the trees themselves, for thousands of acres, killed as completely as if girdled with an axe. The marks of this desolation remain for many years on the spot; and numerous places could be pointed out where, for several years after, scarce a single vegetable made its appearance. By the Indians, a pigeon-roost, or breeding-place, is considered an important source of national profit and dependence. The breeding-place differs from the former in its greater extent. In the western countries above mentioned, these are generally in beech woods, and often extend in nearly a straight line across the country for a great way. Not far from Shelbyville, in the State of Kentucky, about five years ago, there was one of these breeding-places, which stretched through the woods nearly in a north and south direction, was several miles in breadth, and was said to be upwards of forty miles in extent! In this tract almost every tree was furnished with nests wherever the branches could accommodate them. The pigeons made their first appearance there about the 10th of April, and left it altogether, with their young, before the 25th of May. As soon as the young were fully grown, and before they left their nests, numerous parties of the inhabitants, from all parts of the adjacent country, came with wagons, axes, beds, cooking utensils, many of them accompanied by the greater part of their families, and encamped for several days at this immense nursery. Several of them informed me, that the noise in the woods was so great as to terrify their horses, and that it was difficult for one person to hear another speak without bawling in his ear. The ground was strewed with broken limbs of trees, eggs, and young pigeons, which had been precipitated from above, and on which herds of hogs were fattening. Hawks, buzzards, and eagles were sailing about in great numbers, and seizing the young from their nests at pleasure, while, from twenty feet upwards to the top of the trees, the view through the woods presented a perpetual tumult of crowding and fluttering multitudes of pigeons, their wings roaring like thunder, mingled with the frequent crash of falling timber; for now the axe-men were at work cutting down those trees that seemed to be most crowded with nests, and contrived to fell them in such a manner, that in their descent they might bring down several others; by which means the falling of one large tree sometimes produced two hundred young, little inferior in size to the old ones, and almost one mass of fat. On some single tree, upwards of one hundred nests were found, each containing a single young one only—a circumstance in the

history of this bird not generally known to naturalists. It was dangerous to walk under these flying and fluttering millions, from the frequent fall of large branches, broken down by the weight of the multitudes above, and which, in their descent, often destroyed numbers of the birds themselves; while the clothes of those engaged in traversing the woods were completely covered with the excrements of the pigeons.

"These circumstances were related to me by many of the most respectable part of the community in that quarter, and were confirmed in part by what I myself witnessed. I passed for several miles through this same breeding-place, where every tree was spotted with nests, the remains of those above described. In many instances I counted upwards of ninety nests on a single tree; but the pigeons had abandoned this place for another, sixty or eighty miles off, towards Green River, where they were said at that time to be equally numerous. From the great numbers that were constantly passing overhead to or from that quarter, I had no doubt of the truth of this statement. The beech mast had been chiefly consumed in Kentucky, and the pigeons every morning, a little before sunrise, set out for the Indiana territory, the nearest part of which was about sixty miles distant. Many of these returned before ten o'clock, and the great body appeared generally on their return a little after noon. I had left the public road to visit the remains of the breeding-place near Shelbyville, and was traversing the woods with my gun, on my way to Frankfort, when, about one o'clock, the pigeons, which I had observed flying the greater part of the morning north-
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y, began the return in such immense numbers as I never before had witnessed. Coming to an opening, by the side of a creek called the Benson, where I had a more uninterrupted view, I was astonished at their appearance. They were flying with great steadiness and rapidity, at a height beyond gun-shot, in several strata deep, and so close together that, could shot have reached them, one discharge could not have failed of bringing down several individuals. From right to left, as far as the eye could reach, the breadth of this vast procession extended, seeming everywhere equally crowded. Curious to determine how long this appearance would continue, I took out my watch to note the time, and sat down to observe them. It was then half past one. I sat for more than an hour, but, instead of a diminution of this prodigious procession, it seemed rather to increase, both in numbers and rapidity; and, anxious to reach Frankfort before night, I rose and went on. About four o'clock in the afternoon I crossed the Kentucky River, at the town of Frankfort, at which time the living torrent above my head seemed as numerous and as extensive as ever. Long after this I observed them in large bodies, that continued to pass for six or eight minutes, and these again were followed by other detached bodies, all moving in

the same south-east direction till after six in the evening. The great breadth of front which this mighty multitude preserved would seem to intimate a corresponding breadth of their breeding-place, which, by several gentlemen who had lately passed through part of it, was stated to me at several miles. It was said to be in Green County, and that the young began to fly about the middle of March. On the 17th of April, forty-nine miles beyond Danville, and not far from Green River, I crossed this same breeding-place, where the nests for more than three miles spotted every tree; the leaves not being yet out, I had a fair prospect of them, and was really astonished at their numbers. A few bodies of pigeons lingered yet in different parts of the woods, the roaring of whose wings was heard in various quarters around me. All accounts agree in stating that each nest contains only a single young one. These are so extremely fat, that the Indians, and many of the whites, are accustomed to melt down the fat for domestic purposes, as a substitute for butter and lard. At the time they leave the nest, they are nearly as heavy as the old ones, but become much leaner after they are turned out to shift for themselves."

FAMILY PENELOPIDÆ. GUANS AND CURASSOWS.

Of the Guans, Gray writes as follows:—

"The birds of this division are only found in the warmer parts of South America. They mostly reside upon the trees of the vast forests of the interior, near the tops of which they perch during the heat of the day; in the cool of the morning and evening, they are actively engaged in searching, from tree to tree, or on the ground, for their food, which consists of fruits and various insects. Their flight is heavy, and performed with difficulty."

The same author says of the Curassows,—

"The species of this genus are found in the woods of tropical America. They are generally observed together in numerous flocks, searching for worms, insects, fruits, and seeds of plants, on which they subsist. The nests are built on trees, and are formed externally of branches, interlaced with the stalks of herbaceous plants, and lined with leaves."

FAMILY MEGAPODIDÆ. THE MOUND BIRDS.

The habits of the typical genus *Megapodius* serve to illustrate this family.

"The species of this singular genus are found in all the islands of the eastern archipelagos of Asia, and the north-western parts of Australia. They are exclusively met with in pairs in the thick woods of the immediate neighborhood of the sea, and, if disturbed, very quickly hide among the brushwood. They seek their food, which consists of fibrous roots, seeds, berries, and insects, on the ground. Their flight is heavy, and when dis-

turbed, while feeding, they usually fly to a tree, and are said, on alighting, to stretch out their head and neck in a straight line with the body, remaining in this position as stationary and motionless as the branch upon which they are perched. Some species deposit their eggs, to the number of a hundred or more, in the night, in holes on the sea-shore, which they excavate to the depth of three or four feet. Others deposit their eggs in immense conical mounds, composed of sand and shells, with a large mixture of black soil and vegetable matter, the base generally resting on the sandy beach, within a few feet of high-water mark: some of these mounds measure from twenty to sixty feet in circumference, and from five to fifteen in height. After the female has deposited an egg, which is effected in the night, at intervals of several days, and is placed perpendicularly in a hole, near the middle of the mound, to the depth of several feet, she scatters a quantity of sand in the hole until the cavity is filled up. The young are supposed by some to effect their escape from the mound unaided; while, on the other hand, it has been considered that the parent birds, knowing when the young are ready to emerge from their confinement, scratch down, and release them.

Another writer says of these birds,—

"The Megapodidae are a small family of birds found only in Australia and the surrounding islands, but extending as far as the Philippines and north-west Borneo. They are allied to the gallinaceous birds, but differ from these and all others in never sitting upon their eggs, which they bury in sand, earth, or rubbish, and leave to be hatched by the heat of the sun or fermentation. They are all characterized by very large feet, and long, curved claws, and most of the species of *Megapodus* rake and scratch together all kinds of rubbish, dead leaves, sticks, stones, earth, rotten wood, &c., till they form a large mound, often six feet high and twelve feet across, in the middle of which they bury their eggs. The natives can tell by the condition of these mounds whether they contain eggs or not; and they rob them, whenever they can, as the brick-red eggs (as large as those of a swan) are considered a great delicacy. A number of birds are said to join in making these mounds, and lay their eggs together, so that sometimes forty or fifty may be found. The mounds are to be met with here and there in dense thickets, and are great puzzles to strangers, who cannot understand who can possibly have heaped together cart-loads of rubbish in such out-of-the-way places; and when they inquire of the natives, they are but little wiser, for it almost always appears to them the wildest romance to be told that it was done by birds. The species found in Borneo is about the size of a small hen, and entirely of dark olive and brown tints. It is a miscellaneous feeder, devouring fallen fruits, earth-worms, snails, and centipedes, but the flesh is white and well-flavored when properly cooked."

ORDER GALLINÆ. GALLINACEOUS BIRDS.

THE four families—*Pteroclidae*, the Sand Grouse; *Phasianidae*, the Pheasants, Turkeys, and Fowls; *Tetraonidae*, the Grouse, and *Crypturidae*, the Tinamous—are all interesting. They comprehend a very great variety of forms, and are scattered over both continents. Our limits will not permit an extended notice of them, and we will confine ourselves to one of the more interesting species.

Of the *Tetraonidae*, the Pinnated Grouse, or Prairie Chicken, is one of the most important and interesting. Wilson's account of this bird is the best that we have seen. Quoting a letter from a friend, he says,—

"*Amours.*—The season for pairing is in March, and the breeding-time is continued through April and May. Then the male grouse distinguishes himself by a peculiar sound. When he utters it, the parts about the throat are sensibly inflated and swelled. It may be heard on a still morning for three or four miles; some say they have perceived it as far as five or six. This noise is a sort of ventriloquism. It does not strike the ear of a bystander with much force, but impresses him with the idea, though produced within a few rods of him, of a voice a mile or two distant. This note is highly characteristic. Though very peculiar, it is termed *tooling*, from its resemblance to the blowing of a conch or horn from a remote quarter. The female makes her nest on the ground, in recesses very rarely discovered by men. She usually lays from ten to twelve eggs, which are of a brownish color, much resembling those of a Guinea hen. When hatched, the brood is protected by her alone. Surrounded by her young, the mother-bird exceedingly resembles a domestic hen and chickens. She frequently leads them to feed in the roads crossing the woods, on the remains of maize and oats contained in the dung dropped by the travelling horses. In that employment, they are often surprised by the passengers. On such occasions, the dam utters a cry of alarm. The little ones immediately scamper to the brush; and, while they are skulking into places of safety, their anxious parent beguiles the spectator by drooping and fluttering her wings, limping along the path, rolling over in the dirt, and other pretences of inability to walk or fly.

"*Food.*—A favorite article of their diet is the *heath-hen plum*, or partridge-berry. They are fond of huckleberries and cranberries. Worms and insects of several kinds are occasionally found in their crops. But in the winter they subsist chiefly on acorns, and the buds of trees which have shed their leaves. In their stomachs have been sometimes observed the

leaves of a plant supposed to be a wintergreen; and it is said, when they are much pinched, they betake themselves to the buds of the pine. In convenient places, they have been known to enter cleared fields, and regale themselves on the leaves of clover; and old gunners have reported that they have been known to trespass upon patches of buckwheat, and pick up the grains.

"*Migration.*—They are stationary, and never known to quit their abode. There are no facts showing in them any disposition to migration. On frosty mornings, and during snows, they perch on the upper branches of pine trees. They avoid wet and swampy places, and are remarkably attached to dry ground. The low and open brush is preferred to high shrubbery and thickets. Into these latter places they fly for refuge when closely pressed by the hunters; and here, under a stiff and impenetrable cover, they escape the pursuit of dogs and men. Water is so seldom met with on the true grouse ground, that it is necessary to carry it along for the pointers to drink. The flights of grouse are short, but sudden, rapid, and whirring. I have not heard of any success in taming them. They seem to resist all attempts at domestication. In this, as well as in many other respects, they resemble the quail of New York, or the partridge of Pennsylvania.

"*Manners.*—During the period of mating, and while the females are occupied in incubation, the males have a practice of assembling principally by themselves. To some select and central spot, where there is very little underwood, they repair from the adjoining district. From the exercise performed there, this is called a *scratching-place*. The time of meeting is the break of day. As soon as the light appears, the company assembles from every side, sometimes to the number of forty or fifty. When the dawn is past, the ceremony begins by a low tooting from one of the cocks. This is answered by another. They then come forth, one by one, from the bushes, and strut about with all the pride and ostentation they can display. Their necks are incurvated; the feathers on them are erected into a sort of ruff; the plumes of their tails are expanded like fans; they strut about in a style resembling, as nearly as small may be illustrated by great, the pomp of the turkey-cock. They seem to vie with each other in stateliness; and, as they pass each other, frequently cast looks of insult, and utter notes of defiance. These are the signals for battle. They engage with wonderful spirit and fierceness. During these contests, they leap a foot or two from the ground, and utter a cackling, screaming, and discordant cry.

"They have been found in these places of resort even earlier than the appearance of light in the east. This fact has led to the belief that a part of them assemble over night. The rest join them in the morning. This leads to the further belief that they roost on the ground; and the opinion is

confirmed by the discovery of little rings of dung, apparently deposited by a flock which had passed the night together. After the appearance of the sun they disperse.

"These places of exhibition have often been discovered by the hunters : and a fatal discovery it has been for the poor grouse. Their destroyers construct for themselves lurking-holes, made of pine branches, called *bough houses*, within a few yards of the parade. Hither they repair with their fowling-pieces, in the latter part of the night, and wait the appearance of the birds. Watching the moment when two are proudly eyeing each other, or engaged in battle, or when a greater number can be seen in a range, they pour on them a destructive charge of shot. This annoyance has been given in so many places, and to such extent, that the grouse, after having been repeatedly disturbed, are afraid to assemble. On approaching the spot to which their instinct prompts them, they perch on the neighboring trees, instead of alighting at the scratching-place ; and it remains to be observed how far the restless and tormenting spirit of the marksmen may alter the native habits of the grouse, and oblige them to betake themselves to new ways of life.

"They commonly keep together in coveys, or packs, as the phrase is, until the pairing season. A full pack consists, of course, of ten or a dozen. Two packs have been known to associate. I lately heard of one whose number amounted to twenty-two. They are so unapt to be startled, that a hunter, assisted by a dog, has been able to shoot a whole pack, without making any of them take wing. In like manner, the men lying in concealment near the scratching-places have been known to discharge several guns before either the report of the explosion, or the sight of their wounded and dead fellows, would rouse them to flight. It has further been remarked, that, when a company of sportsmen have surrounded a pack of grouse, the birds seldom or never rise upon their pinions while they are encircled, but each runs along until it passes the person that is nearest, and then flutters off with the utmost expedition.

"This bird, though an inhabitant of different and very distant districts of North America, is extremely particular in selecting his place of residence, pitching only upon those tracts whose features and productions correspond with his modes of life, and avoiding immense intermediate regions that he never visits. Open, dry plains, thinly interspersed with trees, or partially overgrown with shrub oak, are his favorite haunts. Accordingly, we find these birds on the grouse plains of New Jersey, in Burlington County, as well as on the brushy plains of Long Island ; among the pines and shrub oaks of Pocono, in Northampton County, Pennsylvania ; over the whole extent of the Barrens of Kentucky ; on the luxuriant plains and

prairies of the Indiana Territory, and upper Louisiana; and, according to the information of the late Governor Lewis, on the vast and remote plains of the Columbia River; in all these places preserving the same singular habits.

"Their predilection for such situations will be best accounted for by considering the following facts and circumstances: First, their mode of flight is generally direct and laborious, and ill calculated for the labyrinth of a high and thick forest, crowded and intersected with trunks and arms of trees, that require continual angular evolution of wing, or sudden turnings, to which they are by no means accustomed. I have always observed them to avoid the high-timbered groves that occur here and there in the Barrens. Connected with this fact is a circumstance related to me by a very respectable inhabitant of that country, viz., that, one forenoon, a cock grouse struck the stone chimney of his house with such force as instantly to fall dead to the ground.

"Secondly, their known dislike of ponds, marshes, or watery places, which they avoid on all occasions; drinking but seldom, and, it is believed, never from such places. Even in confinement, this peculiarity has been taken notice of. While I was in the State of Tennessee, a person living within a few miles of Nashville had caught an old hen grouse in a trap; and, being obliged to keep her in a large cage, as she struck and abused the rest of the poultry, he remarked that she never drank, and that she even avoided that quarter of the cage where the cup containing the water was placed. Happening, one day, to let some water fall on the cage, it trickled down in drops along the bars, which the bird no sooner observed than she eagerly picked them off, drop by drop, with a dexterity that showed she had been habituated to this mode of quenching her thirst, and probably to this mode only, in those dry and barren tracts, where, except the drops of dew and drops of rain, water is very rarely to be met with. For the space of a week, he watched her closely, to discover whether she still refused to drink; but, though she was constantly fed on Indian corn, the cup and water still remained untouched and untasted. Yet no sooner did he again sprinkle water on the bars of the cage, than she eagerly and rapidly picked them off as before.

"The last, and probably the strongest, inducement to their preferring these plains, is the small acorn of the shrub oak, the strawberries, huckleberries, and partridge-berries, with which they abound, and which constitute the principal part of the food of these birds. These brushy thickets also afford them excellent shelter, being almost impenetrable to dogs or birds of prey.

"In all these places where they inhabit, they are, in the strictest sense

of the word, resident, having their particular haunts and places of rendezvous (as described in the preceding account), to which they are strongly attached. Yet they have been known to abandon an entire tract of country, when, from whatever cause it might proceed, it became again covered with forest. A few miles south of the town of York, in Pennsylvania, commences an extent of country, formerly of the character described, now chiefly covered with wood, but still retaining the name of Barrens. In the recollection of an old man born in that part of the country, this tract abounded with grouse. The timber growing up, in progress of years, these birds totally disappeared; and, for a long period of time, he had seen none of them, until, migrating with his family to Kentucky, on entering the Barrens, he, one morning, recognized the well-known music of his old acquaintance, the grouse, which, he assures me, are the very same with those he had known in Pennsylvania.

" But what appears to me the most remarkable circumstance relative to this bird is, that not one of all those writers who have attempted its history has taken the least notice of those two extraordinary bags of yellow skin which mark the neck of the male, and which constitute so striking a peculiarity. These seem to be formed by an expansion of the gullet, as well as of the exterior skin of the neck, which, when the bird is at rest, hangs in loose, pendulous, wrinkled folds along the side of the neck, the supplemental wings, at the same time, as well as when the bird is flying, lying along the neck. But when these bags are inflated with air, in breeding-time, they are equal in size, and very much resemble in color a middle-sized, fully ripe orange. By means of this curious apparatus, which is very observable several hundred yards off, he is enabled to produce the extraordinary sound mentioned above, which, though it may easily be imitated, is yet difficult to describe by words. It consists of three notes of the same tone, resembling those produced by the night hawks in their rapid descent, each strongly accented, the last being twice as long as the others. When several are thus engaged, the ear is unable to distinguish the regularity of these triple notes, there being, at such times, one continued bumbling, which is disagreeable and perplexing, from the impossibility of ascertaining from what distance, or even quarter, it proceeds. While uttering this, the bird exhibits all the ostentatious gesticulations of a turkey-cock — erecting and fluttering his neck and wings, wheeling and passing before the female, and close before his fellows, as in defiance. Now and then are heard some rapid, cackling notes, not unlike that of a person tickled to excessive laughter; and, in short, one can scarcely listen to them without feeling disposed to laugh from sympathy. These are uttered by the males while engaged in fight, on which occasion they leap up against each other, exactly in the manner of turkeys, seemingly

with more malice than effect. This buming continues from a little before daybreak to eight or nine o'clock in the morning, when the parties separate to seek for food.

" Fresh-ploughed fields, in the vicinity of their resorts, are sure to be visited by these birds every morning, and frequently, also, in the evening. On one of these I counted, at one time, seventeen males, making such a continued sound, as, I am persuaded, might have been heard for more than a mile off. The people of the Barrens informed me that, when the weather becomes severe with snow, they approach the barn and farm-house, are sometimes seen sitting on the fencees in dozens, mix with the poultry, and glean up the scattered grains of Indian corn, seeming almost half domesticated. At such times great numbers are taken in traps. No pains, however, or regular plan, has ever been persisted in, as far as I was informed, to domesticate these delicious birds. A Mr. Reed, who lives between the Pilot Knobs and Bairdstown, told me that, a few years ago, one of his sons found a grouse's nest with fifteen eggs, which he brought home, and immediately placed beneath a hen then sitting, taking away her own. The nest of the grouse was on the ground, under a tussock of long grass, formed with very little art, and few materials; the eggs were brownish white, and about the size of a pullet's. In three or four days the whole were hatched. Instead of following the hen, they compelled her to run after them, distracting her with the extent and diversity of their wanderings; and it was a day or two before they seemed to understand her language, or consent to be guided by her. They were let out to the fields, where they paid little regard to their nurse; and, in a few days, only three of them remained. These became extremely tame and familiar, were most expert flycatchers; but, soon after, they also disappeared."

The Gallinaceous birds are all granivorous, feeding upon the produce of the various cerealia, grasses, &c., to which may be added roots, berries, and also insects and their larvæ; the limbs are formed for terrestrial habits, and the hind-toe, as a rule, is placed higher upon the tarsus than the plane of the anterior toes. The wings are mostly rounded, concave, and unfit for rapid or long-continued flight; though, to this rule, some few species afford exceptions. Formed for the ground, these birds walk well, and run with considerable rapidity; the limbs are muscular; the body is stout and heavy; the beak strong and horny, and at its base there is a tough membrane, in which the nostrils are situated. Most are polygamous, and the females lay several eggs. The young are hatched in a state of considerable forwardness, and follow the mother, who broods over them with her wings, and leads them in search of food (seeds and insects), which they themselves pick up. Many roost in trees, others on the ground exclusively.

ORDER BREVIPENNES. SHORT-WINGED BIRDS.

THIS order (the *Cursores* of authors) is composed of but two families—*Struthionidae*, the Ostriches, and *Apterygidae*, the Kivis. In the first family there are but five species, the most important of which are the African Ostrich (*Struthio camelus*), the South American Ostrich (*Rhea Americana*), the Emeu *Dromaius*, and the Cassowary (*Casuarius emeu*).

Of the first-named bird, Gray says,—

"This, the largest of all known birds, inhabits the open plains of Africa, where it is sometimes observed in large flocks, especially if the herbage and vegetation are abundant and fresh, as these form their chief food: the great height of this bird enables it to perceive at a considerable distance over the tall herbage all objects that may be approaching it. When alarmed, it usually escapes with a stately gait, and is soon out of sight, though its pace appears to be but little more than that of walking; and when hard pressed, it runs with great rapidity by the assistance of the wings. The nest is a slight hollow scratched in the sand, six feet in diameter, bordered by a shallow ring. In this nest are laid, generally by two females, about twenty eggs, while in the outer trench are scattered several more. These are considered by the Hottentots as intended for the first food of the young. The male bird sits on the eggs, and attends to the feeding and care of the young, till they are able to provide for themselves."

The same author also says of the South American species, the *R. Americana* and *R. Darwinii*,—

"These birds are found on the plains of South America. They are, says Mr. Darwin, shy, wary, and solitary, and, although so fleet in their pace, they fall a prey without much difficulty. They generally prefer running against the wind, yet on the first start they expand their wings to assist them in their progress. During the heat of the day they sometimes enter a bed of tall rushes, where they squat concealed till quite closely approached. These birds will cross rivers, or pass from island to island, by swimming, which is performed rather slowly, very little of their bodies appearing above the water, and their necks extending a little forwards. They feed on vegetable matter, such as roots and grass; but Mr. Darwin has repeatedly seen three or four come down at low water to the extensive mud banks, which are then dry, for the sake of catching small fish. The nest is a shallow excavation, wherein are placed as many as from twenty-two to seventy, or even eighty, eggs; these are deposited by several females; many eggs are, however, scattered singly over the plains, and thereby become useless. The male

bird alone collects them, and hatches the eggs, and, for some time afterwards, accompanies the young; at which time, the males are occasionally fierce, and even dangerous."

The Cassowary is found in the vast forests of the Molucca Islands and New Guinea. It lives in pairs, feeding on fruits, herbs, and, occasionally, on small animals. It runs with rapidity, and defends itself from the attacks of its enemies by means of its feet. The female deposits three eggs on the bare ground.

The *Apterygidae*, of which there is but one species, the *Apteryx Australis*, are found scattered over various parts of New Zealand, especially those covered with extensive and dense beds of ferns, which afford them a place of concealment when alarmed. They run with swiftness, and sometimes hide in holes of rocks or hollow trees. Their food is supposed to consist of snails, insects, and worms, which they are said to seek for during the night; the worms are obtained by the bird beating the earth with its foot, seizing them with its bill the instant they appear above the ground. The nest is usually placed at the base of a hollow tree, or in deep holes excavated in the ground.

The Emu, or Emeu, sometimes called Australian Cassowary, is another well-known bird. Its food consists of vegetables and seeds, but chiefly of fruits, roots, and herbage. In a state of nature it is very fleet, and affords excellent sport in coursing with dogs, which are, however, rather shy of their game, in consequence of the powerful kicks that the bird can inflict; so powerful, that the settlers say it can break the bone of a man's leg by striking out with its feet. Well-trained dogs, therefore, to avoid this infliction, run up abreast, and make a sudden spring at the neck of the bird. Though the Emeu has bred so frequently in captivity, the mode of making the nest in the wild state does not appear to be well known, though it is generally supposed to be a mere hollow excavated in the earth. The dark-green eggs are six or seven in number. The birds appear to be tolerably constant in pairing, and the male bird sits and hatches the young, while the female watches and guards the nest. The Emeu can produce a hollow, drumming note, well known to those who have attended to its habits in captivity. These birds will, like the Rheas, take to water. Captain Sturt, when descending the Murrumbidgee, in Australia, saw two of them in the act of swimming. They appear to be gregarious, and not very shy in some localities, for Major Mitchell, in his excursions towards Port Philip, found them very numerous on the open downs, and their curiosity brought them to stare at the horses of the party, apparently unconscious of the presence of the riders. In one flock he counted thirty-nine, and they came so near him, that the traveller, having no rifle with him, fired on them with his pistol.

ORDER GRALLEÆ. WADING BIRDS.

In this order are comprehended, by the present system, the following families:—

Otididæ, the Bustards; *Charadriidæ*, the Plovers; *Scolopacidæ*, the Snipes; *Totomidæ*, the Longshanks; *Gruidæ*, the Crames; *Ciconidæ*, the Storks; *Ardeidæ*, the Herons; *Psophidæ*, the Trumpeters; *Palamedeidæ*, the Screamers; *Rallidæ*, the Rails, and *Phœnicopteridæ*, the Flamingoes.

FAMILY OTIDIIDÆ. THE BUSTARDS.

The Bustards, though placed with the Cassowaries and other short-winged birds by many authors, seem to more properly belong with the *Grallæ*. They are found on the open districts of Europe, Asia, and Africa, preferring plains or wide-spreading, extensive downs, dotted with low bushes and underwood—localities which give them an opportunity of desciyng their enemy from afar. They are said to fly but rarely, running from danger with exceeding swiftness, and using their wings, like the ostriches, to accelerate their course. When they do take wing, their flight is low, and they skim along the ground with a sufficiently rapid and sustained flight. Their food consists of vegetables, insects, worms, grains, and seeds. They are polygamous, one male living with many females, which, after fecundation, live solitary. Temminck says that it would seem that they moult twice a year, and that the males, in the greatest number of species, differ from the females in having extraordinary ornaments, and in possessing a more variegated plumage. He further observes that the young males wear the garb of the female during the first and second years, and adds his suspicion that the males in winter have the same plumage as the females. Cuvier notices their massy port, and the slightly-arched and vaulted upper mandible of their beak, which, with the little webs or palmations between the bases of their toes, recall the form of the gallinaceous birds; but he adds that the nudity of the lower part of their legs, all their anatomy, and even the flavor of their flesh, place them among the *Grallæ*, and that, as they have no hind toe, their smallest species approach nearly to the Plovers.

FAMILY CHARADRIIDÆ. THE PLOVERS.

The habits of *Charadrius*, the true Plovers, as given by Gray, will serve as a type of this group.

These birds are found in most parts of the world. They are usually observed in small flocks in the neighborhood of the sea-coast, the bays,

creeks, and mouths of rivers, especially those that are composed of gravel; but, sometimes during the summer months, when they separate in pairs, they frequent the inland banks of rivers, lakes, and the elevated mountains or open moors. Their food consists of small insects of various kinds, in their different states; also small molluscous animals. These they are actively seeking for in the evening and the night, but during the day they generally remain quiet, in a resting posture. Their flight is strong, and performed with rapidity, but does not generally proceed far at a time, and they sometimes run with great swiftness. Their note is composed of a plaintive whistle, often repeated. The nest is a slight hollow, lined with a few stems of dry grass. The eggs are generally four in number, and when they are hatched, the parents protect the young birds until they are able to fly. If disturbed by an enemy, they generally run for some distance from the nest, and then usually pretend that they are unable to fly, tumbling over on the ground, and feigning lameness.

Of the Plovers, the Golden Plover is well known in both the New and Old Worlds. The Kildeer Plover is probably as well known as any other species on this continent.

This species is pretty generally distributed throughout New England as a summer resident. It is not common in any localities, but seems to be found in pairs all along our sea-coast; and, although occasionally breeding in the interior of these States, in the neighborhood of large tracts of water, it is almost exclusively found, during the greater part of the year, in moist fields and meadows, and sandy pastures, within a few miles of the sea. Wilson describes its habits as follows:—

"This restless and noisy bird is known to almost every inhabitant of the United States, being a common and pretty constant resident. During the severity of the winter, when snow covers the ground, it retreats to the sea-shore, where it is found at all seasons; but no sooner have the rivers opened, than its shrill note is again heard, either roaming about high in air, tracing the shore of the river, or running amidst the watery flats and meadows. As spring advances, it resorts to the newly-ploughed fields, or level plains bare of grass, interspersed with shallow pools; or, in the vicinity of the sea, to dry, bare, sandy fields. In some such situation it generally chooses to breed, about the beginning of May. The nest is usually slight, a mere hollow, with such materials drawn in around it as happen to be near, such as bits of sticks, straw, pebbles, or earth. In one instance I found the nest of the bird paved with fragments of clam and oyster shells, and very neatly surrounded with a mound, or border, of the same, placed in a very close and curious manner. In some cases there is no vestige whatever of a nest. The eggs are usually four, of a bright rich cream or yellowish-clay color,

thickly marked with blotches of black. They are large for the size of the bird, measuring more than an inch and a half in length, and a full inch in width, tapering to a narrow point at the great end.

"Nothing can exceed the alarm and anxiety of these birds during the breeding season. Their cries of *kill-deer, kill-deer*, as they winnow the air overhead, dive and course around you, or run along the ground counterfeiting lameness, are shrill and incessant. The moment they see a person approach, they fly or run to attack him with their harassing clamor, continuing it over so wide an extent of ground that they puzzle the pursuer as to the particular spot where the nest or young are concealed, very much resembling, in this respect, the lapwing of Europe. During the evening, and long after dusk, particularly in moonlight, their cries are frequently heard with equal violence, both in the spring and fall. From this circumstance, and their flying about both after dusk and before dawn, it appears probable that they see better at such times than most of their tribe. They are known to feed much on worms, and many of these rise to the surface during the night. The prowling of owls may also alarm their fears for their young at those hours: but, whatever may be the cause, the facts are so.

"The Killdeer is more abundant in the Southern States in winter than in summer. Among the rice-fields, and even around the planters' yards, in South Carolina, I observed them very numerous in the months of February and March. There the negro boys frequently practise the barbarous mode of catching them with a line, at the extremity of which is a crooked pin, with a worm on it. Their flight is something like that of the tern, but more vigorous; and they sometimes rise to a great height in the air. They are fond of wading in pools of water, and frequently bathe themselves during the summer. They usually stand erect on their legs, and run or walk with the body in a stiff, horizontal position: they run with great swiftness, and are also strong and vigorous in the wings. Their flesh is eaten by some, but is not in general esteem; though others say that, in the fall, when they become very fat, it is excellent.

"During the extreme droughts of summer these birds resort to the gravelly channel of brooks and shallow streams, where they can wade about in search of aquatic insects: at the close of summer, they generally descend to the sea-shore in small flocks, seldom more than ten or twelve being seen together. They are then more serene and silent, as well as difficult to be approached."

FAMILY SCOLOPACIDÆ. THE SNIPES.

This large and interesting family is generally distributed over both continents; it contains some of the most valuable game birds, such as the Red-breasted Snipe, the English or Wilson's Snipe, the Woodcocks, the Curlews,

the Avosets, the Phalaropes, &c. Of these birds, Wilson's Snipe, and the American Woodcock, are most familiar to the people of this continent. The *habitat* of the snipe embraces almost the entire continent of America.

The following description of the habits of this interesting bird is taken from the "Ornithology of New England":—

"This snipe is found in New England only as a spring and autumn visitor, rarely breeding here, but passing the season of incubation in higher latitudes. It frequents the fresh-water meadows, where it usually lies concealed during the day, only moving about in dark weather and in the night. In the spring, while with us, it appears to be pairing; and, although associating in small, detached flocks, they are most often found in pairs by themselves. It is during this season that the male performs his well-known gyrations in the air: he ascends to a considerable height, early in the evening, and, almost in the manner of the night-hawk, dives towards the earth, uttering his bleating cry and peculiar, rumbling sound. This species breeds sometimes in the northern portions of New England. It forms a loose nest of grass and a few leaves on the ground, in a bog or wet, swampy thicket; and, about the first week in May, the female lays three or four eggs. These are more pyriform in shape than those of the woodcock, and average about 1.45 by 1.15 inch in dimensions. Their color is an olivaceous drab, marked with spots of brown, which are, at the greater end, confluent into blotches, which almost entirely hide the ground color.

"The snipe has been known to breed in Massachusetts; but the occurrence is very rare, and can be regarded only as accidental. By the 25th of August it returns to the meadows of New England, in small parties of three or four; but it is not abundant much before the 10th or 15th of September, and then is not found in great numbers, unless we have had two or three sharp frosts. The time when sportsmen most expect to find them in numbers is after a north-easterly storm, when the wind veers around to the south-westward. Then the meadows are hunted diligently, and generally with success. We have bagged twenty-four birds in an afternoon's shooting, within ten miles of Boston, and have known that number to be exceeded in favorable weather. The snipe lies close to the ground when approached; and, being a bird of strong scent, as the expression is, is winded to a considerable distance by a good dog. It is easy to imagine the excitement the sportsman experiences, when, with a good dog, he enters a large meadow, and sees him suddenly come to a point; when, walking up to the snipe, and flushing it, the report of his gun, as he shoots the bird, startles from their lurking-places perhaps a dozen others, who fly but a short distance, uttering their peculiar squeak or *scaip*, and then alight in the grass, promising him an abundance of shooting for the day.

"The snipe, when first flushed, rapidly doubles and twists in a quick, zig-zag flight, which it continues for several rods, when it takes a more direct course, almost always against the wind. The sportsman, knowing the habit of the bird, reserves his fire until it has stopped twisting, when his aim is generally successful. Sometimes two birds arise at the same time, when it requires considerable coolness and experience to secure both. I once got three double shots in succession, securing all six birds; but such an occurrence and good luck are rare; and we must be satisfied, in most shooting, to get but single birds."

"The snipe, like the woodcock, probes in the soft earth for worms and animalculæ, which it feeds upon; it also eats the larvae of water insects, and leeches, and occasionally captures grasshoppers and other insects in the wet grass in which it almost constantly resides. It is very difficult of approach in cloudy and windy weather; but in warm, bright days in the fall, it is quiet, and lies until approached quite near. It remains with us until the ground is frozen in the meadows, when it moves to the Southern States, where it passes the winter."

FAMILY TOTANIDÆ. THE LONGSHANKS.

The characteristics of the typical genus *Totanus* will serve for this family. These migratory birds are scattered in both hemispheres, especially in the temperate and northern portions. They are usually seen in pairs, or in small flocks, on the banks of the lakes and rivers, and sometimes on the shores of the ocean; but at certain seasons they resort to the moist woods and marshes for the purpose of rearing their young. Their food is sought for on the ground, or among the gravel and stones on these shores: it consists of insects, worms, and small molluscous animals, and fish. The nest is usually formed in a tuft of grass, or in a slight depression in the earth, which is lined with dry grass and other vegetable matter. The female usually deposits four eggs, and if disturbed while incubating, generally flies around the intruder, uttering, at the same time, a series of shrill notes.

FAMILY GRUIDÆ. THE CRANES.

These large birds are usually found on extensive plains, open ground under cultivation, marshes, or the muddy flats of the sea-shore. They regularly migrate to the warmer parts of the world during autumn and winter, but in summer they retire to northern localities to breed. Their flights are performed during the night in large flocks, generally headed by a leader, who is followed by the remainder in two diverging lines, flying at a great elevation, and uttering, during stormy weather, loud cries, which may be distinctly heard, though the birds are invisible. They find difficulty in rising



AMERICAN SEMIPALMATED PLOVER
(*A. Semipalmatus*)



AMERICAN SNIPE



AMERICAN BITTERN
(*B. Anteicinus*)



AMERICAN SNIPE



GREAT BLUE HERON
(*A. Herodias*)



VIRGINIA RAIL
(*B. Virginianus*)



from the ground, first flying low and heavily, and after a time rising in the air spirally to a great height, flying around in large circles, as if reconnoitring the country to a vast extent for new quarters. When wounded, they possess great courage in defending themselves from the attacks of man, and can inflict very severe wounds with their bills. They feed on grain, seeds, worms, and insects, also small mammals, reptiles, and fish. The nest is usually raised above the ground, sometimes to the height of the body when standing, and is composed of grasses and reeds. The eggs are generally two in number, and both sexes incubate.

FAMILY CICONID.E. THE STORKS.

Mr. Temminck observes that the Storks, as a rule, live in marshes, and feed principally on reptiles, frogs and their spawn, as well as fishes, small mammals, and young birds. They are, in all the old countries, where they occur, a privileged race on account of their utility, and of the havoc they make among the noxious animals. Their migration takes place in great flocks : they are easily tamed. Of these birds, the Common or White Stork of Europe is probably the best known. This species is, from long habit, very tame, approaching the dwellings of man without fear. "In Holland and Germany, especially, the bird is treated as a welcome guest, and there, as indeed elsewhere, it annually returns to the nest which has cradled many generations, on the steeple, on the turret, on the false chimney that the Hollander has erected for its site, in the box, or on the platform which the German has placed for its use. The stump of a decayed tree is sometimes chosen by the bird, and the nest is made of sticks and twigs, on which are laid from three to five cream-colored eggs about the size of those of the common goose. The incubation continues for about a month, when the young are hatched ; these are carefully attended by the parent birds until they are fully feathered and able to obtain food for themselves. In the continental towns domesticated Storks, which have been taken from the nest when young, may be often seen about the markets, where they are recognized as scavengers, cleaning the place of fish, entrails, and other offal, to their own and the citizen's satisfaction.

There are other species, among which are the Black Stork, the African Gigantic Stork, or the Marabou.

FAMILY ARDEID.E. THE HERONS.

This very extensive and generally-distributed group embraces the true Herons, the Egrets, the Bitterns, the Cranes, &c.

These birds, as a rule, frequent the margins of rivers, lakes, or marshes, feeding on fish, reptiles, and even small mammals. Essentially formed for

wading, the legs are very long, and the neck and bill proportionate. In most species the beak is very sharp pointed; the toes are generally elongated; the hind toe is fairly applied to the ground. Though in general they build and breed in societies, they always wander alone in search of food, and, after the breeding season, live apart. Many are adorned with elegant plumes and crests; their wings are ample; their flight buoyant.

The picture which Wilson has drawn of the breeding-places of some of the American herons is worth quoting. The Great Heron, for example, builds a spacious platform of sticks covered with small twigs, on the top of a tall cedar, a community of ten or fifteen pairs usually building in company. "Many of their breeding-places," says Wilson, "occur in both Carolinas, chiefly in the vicinity of the sea. In the lower parts of New Jersey, they have also their favorite places for building and rearing their young. These are generally in the gloomy solitudes of the tallest cedar swamps, where, if unmolested, they continue annually to breed for many years. These swamps are from half a mile to a mile in breadth, and sometimes five or six in length, and appear as if they occupied the former channel of some choked-up river, stream, lake, or arm of the sea. The appearance they present to a stranger is singular: a front of tall and perfectly straight trunks, rising to the height of fifty or sixty feet without a limb, and crowded in every direction, their tops so closely woven together as to shut out the day, spreading the gloom of a perpetual twilight below. On a nearer approach they are found to rise out of the water, which, from the impregnation of the fallen leaves and roots of the cedars, is of the color of brandy. Amid this bottom of congregated springs, the ruins of the former forest lie piled in every state of confusion. The roots, prostrate logs, and, in many places, the water, are covered with green mantling moss, while an undergrowth of laurel, fifteen or twenty feet high, intersects every opening so completely, as to render a passage through laborious and harassing beyond description: at every step you either sink to the knees, clamber over fallen timber, squeeze yourself through between the stubborn laurels, or plunge to the middle in ponds made by the uprooting of large trees, and which the moss concealed from observation. In calm weather the silence of death reigns in these dreary regions; a few interrupted rays of light shoot across the gloom; and, unless for the occasional hollow screams of the herons, and the melancholy chirping of one or two species of small birds, all is silence, solitude, and desolation. When a breeze rises, at first it sighs mournfully through the tops; but, as the gale increases, the tall, mast-like cedars wave like fishing-poles, and, rubbing against each other, produce a variety of singular noises, that, with the help of a little imagination, resemble shrieks, groans, or the growling of beasts of prey."

Wilson gives a similarly interesting account of the breeding-places of the Night Heron or Qua Bird, which has been occasionally seen in Europe as a straggler. "The Night Heron," he tells us, "arrives in Pennsylvania early in April, and immediately takes possession of his former breeding-place, which is usually the most solitary and deeply-shaded part of a cedar swamp. Groves of swamp oak, in retired and inundated places, are also sometimes chosen; and the males not unfrequently select tall woods on the banks of a river to roost in during the day. These last regularly direct their course, about the beginning of evening twilight, towards the marshes, uttering, in a hoarse and hollow tone, the sound *qua*. At this hour, also, all the nurseries in the swamps are emptied of their inhabitants, who disperse about the marshes, and along the ditches and river shore, in quest of food. Some of these breeding-places have been occupied, every spring and summer, for time immemorial, by from eighty to one hundred pairs of Qua Birds. In places where the cedars have been cut down for sale, the birds have merely removed to another quarter of the swamp; but when personally attacked, long teased and plundered, they have been known to remove from an ancient breeding-place, in a body, no one knew where. Such was the case with one on the Delaware, near Thompson's Point, ten or twelve miles below Philadelphia, which, having been repeatedly attacked and plundered by a body of crows, after many severe encounters, the herons finally abandoned the place. Several of these breeding-places occur among the red cedars on the sea-beach of Cape May, intermixed with those of the little White Heron, Green Bittern, and Blue Heron. The nests are built entirely of sticks, in considerable quantities, with frequently three or four nests on the same tree. The eggs are generally four in number, measuring two inches and a quarter in length, by one and three quarters in thickness, and of a very pale light-blue color. The ground or marsh below is bespattered with their excrements, lying all around like whitewash, with feathers, broken egg-shells, old nests, and frequently small fish, which they have dropped by accident, and neglected to pick up. On entering the swamp in the neighborhood of one of these breeding-places, the noise of the old and the young would almost induce one to suppose that two or three hundred Indians were choking or throttling each other. The instant an intruder is discovered, the whole rise in the air in silence, and remove to the tops of the trees in another part of the woods, while parties of from eight to ten make occasional circuits over the spot, to see what is going on. When the young are able, they climb to the highest part of the trees; but, knowing their inability, do not attempt to fly. Though it is probable that these nocturnal birds do not see well during the day, yet their faculty of hearing must be exquisite, as it is almost impossible, with all the precautions one can use, to penetrate near their residence

without being discovered. Several species of hawks hover around, making an occasional swoop among the young; and the bald eagle himself has been seen reconnoitring near the spot, probably with the same design."

FAMILY PSOPHIDÆ. THE TRUMPETERS.

The species of this group are found in the tropical parts of South America, inhabiting the forests, where they search for grain and fruits. They are usually discovered by their peculiar trumpet-like note, which has procured for them their local name. "If disturbed, they seek safety by running, which is performed quickly, and is much assisted by means of expanding their wings. The nest is on the ground, near the base of a tree. The female deposits two eggs."

FAMILY PALAMEDEIDÆ. THE SCREAMERS.

These singular birds are confined to Central and South America. The Chaja (*Chauna Chavarria*), and the Horned Screamer are the best known. Of the former bird, D'Azara gives many interesting particulars. Its sharp, clarion-like cry is exerted not only during the day, but also in the night, if it hears any noise. The note of the male is expressed by the word *chaja*, and that of the female, by the word *chajali*. They are seen sometimes singly, sometimes in pairs, and, at other times, in numerous flocks. They ordinarily frequent marshes. They do not swim, but enter the water like herons, but not, like them, in search of fish or frogs, but for the leaves and seeds of aquatic plants, on which they subsist.

D'Azara saw them brought up among the domestic poultry at country houses, and they were as tame as fowls. The Indians of Carthagena rear them among their geese and other poultry, under the idea that they serve as guards, the Chaja being so courageous as to attack and drive away a vulture. The nests are stated to be spacious, and formed of small branches, on bushes surrounded with water. The eggs are two; the young follow their parents, though clothed only with down.

FAMILY RALLIDÆ. THE RAILS.

In this group are comprehended the Rails proper, the Coots, the Gallinules, the Water-hens, Crakes, &c. They are distributed, generally, in both hemispheres, and their species are numerous and varied. They conceal themselves among the reeds and grasses in marshy places, and run with great facility in such localities, preferring to escape in this manner from pursuit, rather than to take wing. Their food consists of a variety of seeds, small crustacea, insects, &c. They do not probe in the mud, but pick up their food from the surface. Some species are very numerous, and when their homes

are submerged the birds are shot by gunners, to whom they furnish excellent sport, and by epicures are esteemed as most delicious food. Of these birds, the Sora Rail of America is a good example. Of the Coots, or Mud-hens, the habits of the American Coot will serve as an example. Wilson describes its general habits in the following language:—

"This species makes its appearance in Pennsylvania about the first of October. Among the muddy flats and islands of the River Delaware, which are periodically overflowed, and which are overgrown with the reed, or wild oats and rushes, the Coots are found. They are not numerous, and are seldom seen, except their places of resort be covered with water; in that case, they are generally found sitting on the fallen reeds, waiting for the ebb of the tide, which will enable them to feed. Their food consists of various aquatic plants, seeds, insects, and, it is said, small fish. The Coot has an aversion to take wing, and can seldom be sprung in its retreat at low water; for, although it walks rather awkwardly, yet it contrives to skulk through the grass and reeds with great speed, the compressed form of its body, like that of the Rail genus, being well adapted to that purpose. It swims remarkably well; and, when wounded, will dive like a duck. When closely pursued in the water, it generally takes to the shore, rising, with apparent reluctance, like a wounded duck, and fluttering along the surface, with its feet pattering on the water. It is known in Pennsylvania by the name of the Mud-hen."

FAMILY PHENICOPTERIDÆ. THE FLAMINGOES.

The *Phoenicopteridæ* include a single genus, *Phoenicopterus*. The position of these birds, in the systems of ornithologists, has been a doubtful one, some placing them with the swimmers, others with different groups of the Grallæ: the present position seems the most natural one.

Temminck, in giving the habits of these birds, says that they live on the sea-beach, or in marshes formed by salt lakes, where their food consists of testaceous mollusks, marine insects, and the spawn of fish, which they collect by plunging their long neck into the water, and turning the head upside down, so as to employ with greater advantage the bend of their bill. They join in large troops, and live in societies. Their nest is made in the marshes, and consists of earth piled up; upon this nest the birds sit astride, because their length of limb hinders them from incubating otherwise. Whether they are reposing or fishing, sentinels are appointed, which keep a sort of guard. If anything alarms the sentinel, he utters a trumpeting cry, and all the birds of the flock follow him into the air. They rarely take their repose in any other than open places; and it is asserted that their sense of smelling is so acute, that they can scent from afar the hunter and fire-arms.

ORDER LAMELLIROSTRES. GEESE, DUCKS, AND MERGANSERS.

THIS very large, widely-distributed, and extremely-varied group, comprehends some of the most valuable birds which have been used for the support of man.

In the family *Anatidae* are comprehended all the Geese and Ducks of the world, and in the *Mergidae* are placed the Sheldrakes and Mergansers.

FAMILY ANATIDÆ. GEESE AND DUCKS.

Of the ducks, the Mallard and Eider Ducks are well known in both hemispheres; and the far-famed Canvas-back Duck is known to almost every inhabitant of the United States.

Wilson's account of the last-named species is one of the most interesting that we have met with. He says,—

"The Canvas-back Duck arrives in the United States, from the north, about the middle of October; a few descend to the Hudson and Delaware; but the great body of these birds resort to the numerous rivers belonging to, and in the neighborhood of, the Chesapeake Bay, particularly the Susquehanna, the Patapsco, Potomac, and James Rivers, which appear to be their general winter rendezvous. Beyond this, to the south, I can find no certain accounts of them. At the Susquehanna, they are called Canvas-backs; on the Potomac, White-backs; and on James River, Sheldrakes. They are seldom found at a great distance up any of these rivers, or even in the salt-water bay, but in that particular part of tide-water where a certain grass-like plant grows, on the roots of which they feed. This plant, which is said to be a species of *Vallisneria*, grows on fresh-water shoals of from seven to nine feet (but never where these are occasionally dry), in long, narrow, grass-like blades, of four or five feet in length: the root is white, and has some resemblance to small celery. This grass is in many places so thick that a boat can with difficulty be rowed through it, it so impedes the oars. The shores are lined with large quantities of it, torn up by the ducks and drifted up by the winds, lying, like hay, in windrows. Wherever this plant grows in abundance, the Canvas-backs may be expected, either to pay occasional visits, or to make it their regular residence during the winter. It occurs in some parts of the Hudson; in the Delaware, near Gloucester, a few miles below Philadelphia, and in most of the rivers that fall into the Chesapeake, to each of which particular places these ducks resort; while, in waters unprovided with this nutritive plant, they are altogether unknown."

"On the first arrival of these birds in the Susquehanna, near Havre de Grace, they are generally lean; but such is the abundance of their favorite food, that, towards the beginning of November, they are in pretty good order. They are excellent divers, and swim with great speed and agility. They sometimes assemble in such multitudes as to cover several acres of the river, and, when they rise suddenly, produce a noise resembling thunder. They float about these shoals, diving and tearing up the grass by the roots, which is the only part they eat. They are extremely shy, and can rarely be approached, unless by stratagem. When wounded in the wing, they dive to such prodigious distances, and with such rapidity, continuing it so perseveringly, and with such cunning and active vigor, as almost always to render the pursuit hopeless. From the great demand for these ducks, and the high price they uniformly bring in market, various modes are practised to get within gunshot of them. The most successful way is said to be by decoying them to the shore by means of a dog, while the gunner lies closely concealed in a proper situation. The dog, if properly trained, plays backwards and forwards along the margin of the water; and the ducks, observing his manœuvres, enticed perhaps by curiosity, gradually approach the shore, until they are sometimes within twenty or thirty yards of the spot where the gunner lies concealed, and from which he rakes them, first on the water, and then as they rise. This method is called *tolling them in*. If the ducks seem difficult to decoy, any glaring object, such as a red handkerchief, is fixed round the dog's middle or to his tail; and this rarely fails to attract them. Sometimes, by moonlight, the sportsman directs his skiff towards a flock, whose position he had previously ascertained, keeping within the projecting shadow of some wood, bank, or headland, and paddles along so silently and imperceptibly as often to approach within fifteen or twenty yards of a flock of many thousands, among whom he generally makes great slaughter.

"Many other stratagems are practised, and, indeed, every plan that the ingenuity of the experienced sportsman can suggest, to approach within gunshot of these birds; but, of all the modes pursued, none intimidate them so much as shooting them by night; and they soon abandon the place where they have been thus repeatedly shot at. During the day they are dispersed about, but towards evening, collect in large flocks, and come into the mouths of creeks, where they often ride, as at anchor, with their head under their wing, asleep, there being always sentinels awake, ready to raise an alarm on the least appearance of danger. Even when feeding and diving in small parties, the whole never go down at one time, but some are still left above on the lookout.

"When the winter sets in severely, and the river is frozen, the Canvas-

backs retreat to its confluence with the bay; occasionally frequenting air-holes in the ice, which are sometimes made for the purpose, immediately above their favorite grass, to entice them within gunshot of the hut or bush, which is usually fixed at a proper distance, and where the gunner lies concealed, ready to take advantage of their distress. A Mr. Hill, who lives near James River, at a place called Herring Creek, informs me that, one severe winter, he and another person broke a hole in the ice, about twenty by forty feet, immediately over a shoal of grass, and took their stand on the shore in a hut of brush, each having three guns well loaded with large shot. The ducks, which were flying up and down the river, in great extremity, soon crowded to this place, so that the whole open space was not only covered with them, but vast numbers stood on the ice around it. They had three rounds, firing both at once, and picked up eighty-eight Canvas-backs, and might have collected more, had they been able to get to the extremity of the ice after the wounded ones. In the severe winter of 1779–80, the grass, on the roots of which these birds feed, was almost wholly destroyed in James River. In the month of January the wind continued to blow from W.N.W. for twenty-one days, which caused such low tides in the river that the grass froze to the ice everywhere; and a thaw coming on suddenly, the whole was raised by the roots, and carried off by the freshet. The next winter a few of these ducks were seen, but they soon went away again, and for many years after they continued to be scarce; and, even to the present day, in the opinion of my informant, have never been so plenty as before."

Of the Eider Duck and its habits, the following account will give a good idea:—

"Its native country extends from about 45° north to the highest arctic latitudes hitherto explored, both in Europe and America,—the Farn Isles, off the coast of Northumberland, and the rocky islets beyond Portland, in the district of Maine, being the southern boundary of their breeding-places; but they are only very plentiful in Behring's Straits, Labrador, Greenland, Iceland, and other arctic regions. Selby, however, thinks that they might be greatly increased in the Farn Islands by proper attention.

"According to M. T. Brunnich, who wrote an express treatise on the natural history of the Eider Duck, their first object, after pairing, is to procure a suitable place for their nest, preferring the shelter of a juniper bush, where it can be had, and where there is no juniper, contenting themselves with tufts of sea-grass, bundles of sea-weed cast up by the tide, the crevices of rocks, or any hollow place which they can find. Some of the Icelandic proprietors of breeding-grounds, in order to accommodate them, cut out holes in rows on the smooth, sloping banks, where they would not otherwise

build, but of which they gladly take possession when thus scooped out. It is not a little remarkable that, like several other sea-birds, they almost always select small islands, their nests being seldom, if ever, found on the shores of the mainland, or even of a large island. The Icelanders are so well aware of this, that they have expended a great deal of labor in actually forming islands, by separating from the main island certain promontories joined to it by narrow isthmuses.

"Both the male and the female Eider Ducks work in concert in building their nest, laying a rather coarse foundation of drift grass, dry tangle, and sea-weed, which is collected in some quantity. Upon this rough mattress the female Eider spreads a bed of the finest down, plucked from her own breast, and by no means sparingly, but, as Brunnich informs us, heaping it up, so as to form a thick, puffed roll quite round the nest. When she is compelled to go in quest of food, after beginning to sit, she carefully turns this marginal roll of down over the eggs to keep them warm till her return. Martens says she mixes the down with moss, but, as this is not recorded by any other observer, we think it is not a little doubtful, particularly as in the places chosen for nestling she would find it no easy matter to procure moss. It is worthy of remark that, though the Eider Duck lays only five or six eggs, 'it is not uncommon to find more than even ten and upwards in the same nest occupied by two females which live together in concord.'

"The quantity of down in each nest is said, by Van Troil, to be about half a pound, which, by cleaning, is reduced one half. By Pennant, who examined the Eider's nest in the Farn Islands, off Northumberland, it is only estimated, when cleaned, at three quarters of an ounce, and this was so elastic as to fill the crown of the largest hat. The difference of quantity in these two accounts, theoretically ascribed by the translators of Buffon to difference of climate, may have arisen from the one being the first, and the other the second or third nest of the mother duck; for if the first nest be plundered of its down, though she immediately builds a second, she cannot furnish it with the same quantity as before; and, if forced to build a third time, having then stripped her breast of all she could spare, the male is said to furnish what is wanting, which is recognized as being considerably whiter than the female's. When the nest is not robbed, it is said that he furnishes none.

"The down taken from the nests becomes a valuable article of commerce, being sold, when cleaned, for three rix-dollars (twelve shillings) a pound. In 1750, the Icelandic company sold down amounting in value to about 850*l.*, besides what was sent directly to Gluckstadt. Little or none of it is used in the country where it is found. In that rough climate, as Buffon remarks, the hardy hunter, clothed in a bearskin cloak, enjoys in his solitary hut a

peaceful, perhaps a profound sleep, while, in polished nations, the man of ambition, stretched upon a bed of Eider-down, and under a gilded roof, seeks in vain to procure the sweets of repose."

Of the geese, the Wild or Canada Goose of America is a good example.

This well-known bird passes through or over New England in the spring and autumn migrations, appearing in the former about the first week in April, and passing in flocks until the tenth of that month. In the autumn, it returns as early as the last week in September; and from then until the first of December, and even later, it passes in flocks in its southern migrations. The Wild Goose, as the rule, breeds in the most northern portions of the continent: it sometimes passes the season of incubation in the limits of the United States; but the occurrences are very few of its having been found to remain in New England. The nest is located in some retired place, not far from the water, generally among the thickest grass, and not unfrequently under a bush. It is carelessly formed of dry plants of various kinds, and is of a large size, flat, and raised to the height of several inches. The eggs are usually about six in number: they average three and a half inches by two and a half, are thick-shelled, rather smooth, and of a very dull yellowish-green color. The period of incubation is twenty-eight days. Wilson says of this bird,—

"Their first arrival on the coast of New Jersey is early in October; and their first numerous appearance is the sure prognostic of severe weather. Those which continue all winter frequent the shallow bays and marsh islands, their principal food being the broad, tender, green leaves of a marine plant, which grows on stones and shells, and is usually called sea-cabbage; and also the roots of the sedge, which they are frequently observed in the act of tearing up. Every few days they make an excursion to the inlets on the beach for gravel. They cross, indiscriminately, over land and water, generally taking the nearest course to their object, differing, in this respect, from the brant, which will often go a great way round by water, rather than cross over the land. They swim well; and, if wing-broken, dive, and go a long way under water, causing the sportsman a great deal of fatigue before he can kill them. Except in very calm weather, they rarely sleep on the water, but roost all night in the marshes. When the shallow bays are frozen, they seek the mouths of inlets near the sea, occasionally visiting the air-holes in the ice; but these bays are seldom so completely frozen as to prevent them from feeding on the bars.

"The flight of the Wild Geese is heavy and laborious, generally in a straight line, or in two lines, approximating to a point, thus, >; in both cases, the van is led by an old gander, who, every now and then, pipes his well-known *honk*, as if to ask how they come on; and the honk of 'All's

well' is generally returned by some of the party. Their course is in a straight line, with the exception of the undulations of their flight. When bewildered in foggy weather, they appear sometimes to be in great distress, flying about in an irregular manner, and for a considerable time over the same quarter, making a great clamor. On these occasions, should they approach the earth and alight (which they sometimes do, to rest and re-collect themselves), the only hospitality they meet with is death and destruction from a whole neighborhood, already in arms for their ruin."

FAMILY MERGIDE. MERGANSERS.

The Hooded Merganser is one of the most interesting of these birds. This beautiful bird, though found in the whole of our continent, is less common than either of the other mergansers on our coast, and in our bays and inlets, in autumn, winter, and early spring. In the summer, it resides in the interior, where it breeds by the lakes and other bodies of fresh water, building its nest in holes in high, dead trees, or on the tops of stubs, thirty or forty feet from the ground, exactly like the sheldrake. The eggs are from nine, to twelve or fourteen in number, usually about ten. They are of a clear-white color, although their surface is, in some specimens, stained by the moisture from the feet of the bird.

When the nest of this species is approached, the female remains quiet, and flies off only when alarmed by blows on the trunk of the tree on which her nest is built. She then flies silently, and alights in the lake, near which the nest is usually built, and watches the intruder from a safe distance, without making any outeries or disturbance. If the tree is surrounded by undergrowth so thick that she cannot see the intruder from the water, she flies silently over and around him, always at a safe distance. The male never shows himself on such occasions; and we think it likely that he separates from his mate at the commencement of the period of incubation, and remains by himself until the young are able to provide for themselves.

When living in the neighborhood of fresh water, this bird has many of the habits of the other mergansers, and then feeds on aquatic insects and their larvæ, and is an expert fisher and diver.

When the female is suddenly surprised, while with her young in a stream or pond, she gives a guttural, chattering cry, when the whole brood dives, and swims off under water to the shore, where they conceal themselves in the aquatic herbage. This species, in passing with its young from one body of water to another, often, while flying, carries them singly in its mouth; and we have been told that, even after it has been shot, and has fallen to the ground, it not unfrequently holds the chick. The female of the summer duck often encroaches on the nest of this Merganser.

ORDER STEGANOPODES. PELICANS, GANNETS, AND BOOBIES.

THIS group is also varied, and widely distributed in both hemispheres.

FAMILY PELICANIDÆ. THE PELICANS.

In this family are comprehended the *Phaethoninae*, or Tropic Birds; the *Plotinae*, or Darters; the Pelicans, Gannets, and Cormorants.

The true Pelicans are large and heavy birds, with a great extent of wing, and are excellent swimmers. Their expansive pouch, whose elasticity is well known to all who have witnessed the shapes into which it is stretched and formed in museums, will hold a considerable number of fish, and thus enables the bird to dispose of the superfluous quantity which may be taken during fishing expeditions, either for its own consumption, or for the nourishment of its young. In feeding the nestlings (and the male is said to supply the wants of the female in the same manner), the under mandible is pressed against the neck and breast to assist the bird in disgorging the contents of the capacious pouch.

The neighborhood of rivers, lakes, and the sea-coasts are the haunts of the Pelicans, and they are gregarious to a great extent. Their food consists entirely of fishes, which they capture with great dexterity, generally in shallow inlets. They do not dive, but they often dash, from a great height, on the wing, upon a fish, with such velocity that they become submerged, though their buoyancy brings them instantly to the surface again. Although they perch on trees, they generally seem to prefer rocky shores. The nest, commonly formed of coarse, reedy grass, with a lining of grass of a softer quality, is large, and made upon the ground. The eggs, which are white, are usually two in number. They are found abundantly in both hemispheres.

The Cormorants exist abundantly in all parts of the globe. They are mostly found on the sea-coast, breeding on rocky ledges, difficult of access, and also on trees. They are exceedingly expert in catching fish, being very active in the water, and capable of remaining under its surface for a great length of time.

The Gannets, whose habits resemble those of the pelicans, usually frequent almost inaccessible rocky islands, where they congregate in great numbers during the season of reproduction, at other times migrating along the coast. Their flight is rapid, powerful, and long-continued.

The common Gannet is a well-known species in this country. This bird

is quite common on our coast in the autumn and spring, and through the greater part of the winter. Audubon, in describing its breeding habits, says, —

"The newly-finished nest of this bird is fully two feet high, and quite as broad externally. It is composed of sea-weeds and maritime grasses, the former being, at times, brought from considerable distances. Thus, the Gannets breeding on the rocks in the Gulf of St. Lawrence carry weeds from the Magdalene Islands, which are about thirty miles distant. The grasses are pulled or dug up from the surface of the breeding-place itself, often in great clods, consisting of roots and earth, and leaving holes not unlike the entrances to the burrows of the puffin. The nests, like those of the cormorants, are enlarged or repaired annually. The single egg, of a rather elongated oval form, averages $3\frac{1}{2}$ inches in length, by 2 inches in its greatest breadth; and is covered with an irregular, roughish coating of white calcareous matter, which, on being scraped off, leaves exposed the pale greenish-blue tint of the under surface."

The Gannet breeds in almost incredible numbers on some of the rocky islands near the coast of Labrador. When the breeding season is over, it wanders as far south as the Gulf of Mexico. Its mode of flight is powerful, and, at times, graceful. Its food consists of fish, principally herrings; these are obtained by plunging from on high, often remaining under water for a minute or more at a time.

The Darters, or Snake Birds, are among the most interesting of this group. Buffon, in describing one of them, says, —

"The Arhinza offers us a reptile grafted on the body of a bird." Those who have seen the long neck, and that only issuing from the water, twisting about among the herbage, and among the foliage, say that the casual observer might well take it for a snake. Vaillant states that the neck of the species seen by him in Africa was always in oscillation when the bird was perched; and that any one, who saw its tortuous movements among the foliage, the body being concealed, would take it for one of the tree-serpents.

Le Vaillant describes them as diving for fish; when they caught a small one, it was swallowed whole; when they captured a large one, it was carried to a rock, or the trunk of a tree, and the bird, fixing it beneath its feet, picked it to pieces with its bill. Though the water is their favorite element, it is upon rocks or trees that they establish their nests, and bring up their young, taking care that they may be easily precipitated into the river as soon as they are able to swim, or whenever the safety of the little family requires it.

The habits of the species of America are similar to those of the Old World birds.

ORDER LONGIPENNES. LONG-WINGED BIRDS.

THIS group, though not one of the largest, is, nevertheless, quite interesting. It consists of the two families, *Laridae*, the Gulls, and *Procellariidae*, the Petrels.

FAMILY PROCELLARIDÆ. THE ALBATROSSES AND PETRELS.

The common Albatross is the largest sea-bird known: it is often met with in the southern seas. Its food, as with the others, consists of fish, which it has been known to eat to the extent of five pounds at a meal. "These birds do not confine themselves entirely to fish, but will prey on other sea-animals. The Kamtschatkades take them by fastening a cord to a large hook, baited with a whole fish, which the birds greedily seize."

Of the Petrels, the Stormy Petrel is the most interesting. The power of wing of this bird is so great that it is enabled to sweep over the ocean, at every distance from land, and even to weather the most tempestuous winds, while, with its webbed feet and light form, it can actually walk upon the billows with as much ease as a sparrow can hop along a garden walk. "It is, indeed, an interesting sight," says Wilson, "to observe these little birds, in a gale, coursing over the waves, down the declivities, and up the ascents of the foaming surf that threatens to burst over their heads, sweeping along the hollow troughs of the sea, as in a sheltered valley, and again mounting with the rising billow, and just above its surface occasionally dropping their feet, which, striking the water, throw them up again with additional force; sometimes leaping, with both legs parallel, on the surface of the roughest waves for several yards at a time. Meanwhile they continue coursing from side to side of the ship's wake, making excursions far and wide to the right and to the left, now a great way ahead, and now shooting astern for several hundred yards, returning again to the ship as if she were all the while stationary, though perhaps running at the rate of ten knots an hour. But the most singular peculiarity of this bird is its faculty of standing, and even running, on the surface of the water, which it performs with apparent facility. When any greasy matter is thrown overboard, these birds instantly collect around it, facing to windward, with their long wings expanded, and their webbed feet patting the water. The lightness of their bodies, and the action of the wind on their wings, enable them with ease to assume this position. In calm weather they perform the same manœuvre by keeping their wings just so much in action as to prevent their feet from sinking below the surface."

"There are," says the same writer in another place, "few persons who have crossed the Atlantic that have not observed these solitary wanderers of the deep, skimming along the surface of the wild and wasteful ocean; flitting past the vessel like swallows, or following in her wake, gleaning their scanty pittance of food from the rough and whirling surges. Habited in mourning, and making their appearance generally in greater numbers previous to, or during, a storm, they have long been fearfully regarded by the ignorant and superstitious not only as the foreboding messengers of tempests and dangers to the hapless mariner, but as wicked agents, connected, somehow or other, in creating them. 'Nobody,' say they, 'can tell anything of where they come from, or how they breed, though (as sailors sometimes say) it is supposed that they hatch their eggs under their wings as they sit on the water.' This mysterious uncertainty of their origin, and the circumstances above recited, have doubtless given rise to the opinion, so prevalent among this class of men, that they are in some way or other connected with the prince of the power of the air. In every country where they are known, their names have borne some affinity to this belief. They have been called Witches, Stormy Petrels, the Devil's Birds, and Mother Cary's Chickens,* probably from some celebrated ideal hag of that name; and their unexpected and numerous appearance has frequently thrown a momentary damp over the minds of the hardiest seamen. It is the business of the naturalist, and the glory of philosophy, to examine into the reality of these things, to dissipate the clouds of error and superstition wherever they darken and bewilder the human understanding, and to illustrate nature with the radiance of truth."

When we inquire, accordingly, into the unvarnished history of this ominous bird, we find that it is by no means peculiar in presaging storms, for many others, of very different families, are evidently endowed with an equally nice perception of a change in the atmosphere. Hence it is that, before rain, swallows are seen more eagerly hawking for flies, and ducks carefully trimming their feathers, and tossing up water over their backs to try whether it will run off again without wetting them. But it would be as absurd to accuse the swallows and ducks on that account of being the cause of rain, as to impute a tempest to the spiteful malice of the poor Petrels. Seamen ought rather to be thankful to them for the warning which their delicate feelings of aerial change enable them to give of an approaching hurricane.

"As well," says Wilson, "might they curse the midnight lighthouse, that, star-like, guides them on their watery way, or the buoy that warns them of

* This name seems to have been originally given them by Captain Carteret's sailors, who met with these birds on the coast of Chili.

the sunken rocks below, as this harmless wanderer, whose manner informs them of the approach of the storm, and thereby enables them to prepare for it." The Petrels are nocturnal birds. When, therefore, they are seen flying about and feeding by day, the fact appears to indicate that they have been driven from their usual quarters by a storm; and hence, perhaps, arose the association of the bird with the tempest. Though the Petrels venture to wing their way over the wide ocean as fearlessly as our swallows do over a mill-pond, they are not, therefore, the less sensible to danger; and, as if feelingly aware of their own weakness, they make all haste to the nearest shelter. When they cannot then find an island or rock to shield them from the blast, they fly towards the first ship they can descry, crowd into her wake, and even close under the stern, heedless of the rushing surge, so that they can keep the vessel between them and the unbroken sweep of the wind.

FAMILY LARIDÆ. GULLS, SKUAS, AND TERNS.

The Gulls proper frequent the shores of the ocean, but often wander to great distances from land; they are incapable of diving, but swim buoyantly. Their food consists principally of fish and crustacea; but some of the larger species feed occasionally on the flesh of cetaceous animals, and devour the young and eggs of some species of sea-birds. These birds vary much in size, some being quite small, while others rank among the largest of marine birds. They are not peculiar to any region, but are found abundantly over the world. They congregate in great numbers on the sand-bars at the entrance of inlets and large bays. In winter they migrate in search of food, frequenting harbors, and ascending rivers.

Nearly resembling the Gulls proper are the Skua-gulls, or Jægers.

These hardy birds inhabit the high latitudes of both hemispheres. There are four arctic species, found both in Europe and North America. They are piratical in their habits, appearing to derive their subsistence mainly from the labors of others. They chase and harass various species of gulls, compelling them to disgorge a portion of their food, which they dart after, and seize before it reaches the water.

The Terns are mostly found on the sea-coast and neighboring bays, occasionally on rivers and lakes; they assemble in large numbers on the sand-bars and points at the mouths of inlets, are much on the wing, and are remarkable for their buoyant and easy flight. Their food consists of small fishes and crustacea, which they obtain by hovering over and suddenly darting down upon. Although they thus seize their prey while in the water, they only occasionally swim or rest upon its surface. These birds are sociable in their habits, congregating in large communities in the breeding season, and nesting near each other on the ground.

ORDER PYGOPODES. SHORT-WINGED BIRDS.

THE four families which are comprehended in this group are distributed throughout all portions of the globe. Our limits will not permit us to review them in detail, and we will glance at but few of the most interesting.

FAMILY PODICIPIDÆ. THE GREBES.

These birds are found in salt as well as fresh-water rivers, are excellent swimmers, and dive frequently. They feed on small fishes, frogs, crustaceans, and insects, and their nests, formed of a large quantity of grass and weeds, are generally placed among reeds and carices, and rise and fall with the water. The plumage is very soft, and, on the under surface, silky: they are remarkably active on the water, and when alarmed remain below the surface, exposing only the bill.

The following account of the habits of the Red-billed Grebe (*Podilymbus podiceps*), is sent us by a friend in Wisconsin: "This bird breeds abundantly in Pewaukee Lake, and, I presume, throughout Wisconsin. It nests about the middle of May, in rushes of the former year's growth, and in water from one to two feet deep. In such situations, the old rushes, that have fallen down into the water, are pulled together, and continually piled upon each other, until the fabric rises above the water; the nest is then formed of moss and weeds gathered from the bottom. It is raised but little, and is always wet, except when the water has fallen, and left the nest higher than it was originally built. It appears like a circular mass of weeds and moss floating on the water, or, when filled with eggs, carefully covered, like a floating ball; but it does not really float, as the foundation rests more or less upon the bottom. By pressing on the nest with the hand, it can generally be easily sunk. The eggs (four or five in number) are white at first, but soon get stained by contact with the wet nest. When left, they are carefully covered by the bird. It is surprising how quick and effectually the eggs are covered if the nest is approached, the bird always getting away without being seen. I have examined more than twenty nests this summer, both with and without eggs; in some cases, on examining the bottom, near the empty nests, I was able to find the eggs that had rolled out and sunk. All of the nests were alike (always in one or two feet of water), and constructed of rushes (the foundation), never of grass, weeds, or flag, which were as plenty, and would seem equally as appropriate materials. The bird is very shy during the breeding season, keeping out of sight among the weeds and rushes."

FAMILY COLYMBIDÆ. THE LOONS AND DIVERS.

These birds excel all others in diving, and their powers of swimming, and their endurance while submerged, are wonderful: their food consists of fish, which they pursue and capture while beneath the water. They frequent the fresh and salt water, and breed in the high latitudes. They nest on the ground, usually on some small island, and lay two or three eggs, which are not large for the size of the bird. Most species perform migrations, while one or two remain in northern localities through the winter.

FAMILY ALCIDÆ. THE AUKS, GUILLEMOTS, AND PUFFINS.

These birds are strictly oceanic birds, scarcely ever leaving the water, except for the purposes of incubation. They breed in communities in caverns and on rocky cliffs, laying one, two, or three large eggs. Some species dig burrows for the purpose of nesting, and others are said to occupy the burrows of rabbits and other small mammals. Their food, which they obtain by diving (an operation in which they are materially assisted by their wings, as well as by their feet), consists of small fishes, crustaceans, and other marine animals. The young are said to be fed from the crops of their parents, not only before they are able to leave the place of their birth, but also for some time afterwards. The breeding-places of these birds are frequently visited by eggers and fishermen, and the numbers of eggs, and the amount of feathers which they obtain, is surprisingly large.

FAMILY APTENODYTIDÆ. THE PENGUINS.

In these birds the wing is almost wanting, being merely rudimentary: they seem to replace, in the southern hemisphere, the auks, which occur in the northern. They associate in immense numbers, and their breeding-places cover acres in extent. Sir John Narborough says of the Patagonian Penguins, that their erect attitude, and their bluish-black backs, contrasted with their white bellies, might cause them to be taken at a distance for young children with white bibs. The towns of these birds at the Falkland Islands have attracted particular attention. Some of these assemblies are described as giving a dreary, not to say awful, impression of the desolation of the place, and the utter absence of the human race. In some of the towns it is stated there is a general stillness, and when intruders walk among the feathered population, they are regarded with sidelong glances, but seem to carry no terror with them. In many places the shores are covered with them, and hundreds have been taken in an hour. The females hatch the eggs by keeping them close between their thighs; and if approached during incubation, are said to move away, carrying their eggs with them.



WHITE STORK



RUFF



AVOSET



CURLEW



THE COMMON COOT.



COMMON GALLINULE

CLASS III. REPTILIA.

WE have now arrived at a class of animals, in the production of which nature has seemed to deviate from her usual plan of beauty and utility, as all the orders, comprising the series, with the exception of the first, are calculated to create in man feelings of the deepest disgust, aversion, and often terror. The grotesque forms, in which ugliness and deformity manifest themselves in multifarious variety, the utter uselessness of all, save the exception just named, and the venomous and dangerous character of many, have caused them in all ages to be regarded by man as symbols of moral degradation and types of all evil. We instinctively shrink from contact with them, and start with a shudder when one is suddenly and unexpectedly revealed to our sight. It is difficult to define or describe that emotion of dread which one experiences when the cold and slimy snake glides along at his feet, with its forked tongue and menacing hiss. Even the touch of the harmless toad will produce sensations of the most disagreeable character.

The animals of this class have the heart so constructed, that at its several contractions it sends only a portion of the blood into the lungs, the remainder returning into the general circulation without being subjected to respiration. "As respiration imparts warmth to the blood, reptiles are consequently cold-blooded, and their aggregate muscular energy is less than in the mammalia, and much less than in birds. Hence their movements can scarcely be performed otherwise than by crawling or swimming; and though several of them leap and run with celerity on certain occasions, their habits are generally sluggish, their digestion excessively slow, their sensations obtuse, and, in cold or temperate climates, they pass nearly the whole winter in a state of lethargy. Their proportionally very diminutive brain is less necessary than in the two preceding classes for the exercise of their animal and vital functions; their sensations seem to be less referable to a common centre; they contrive to live and to execute voluntary movements for a considerable time after having been deprived of the brain, and even when the head is severed. Their heart pulsates for many hours after it has been detached, and its loss does not deprive the body of mobility for a still longer period. The smallness of the pulmonary vessels enables them to suspend respiration without arresting the course of the blood, and thus to remain submerged for a longer time than mammalia or birds."

As the amount of respiration in this class is not fixed, as in the mammalia and birds, but varies according to the relative proportion of the diameter of the pulmonary artery, as compared with that of the aorta, some respire

much more than others. Thus, in the tortoises and lizards, respiration is the most full and perfect. In the frogs it is much less. Following this fact, and comparing the extent of respiration with their organs of movement, M. Brouniart has divided them into four orders, as follows: The *Chelonians*, or Turtles and Tortoises; the *Saurians*, or Lizards; the *Ophidians*, or Serpents; and the *Anomaloglossians*, or Frogs.

ORDER I. CHELONIA (The Turtles and Tortoises).

The Chelonians have a heart with two auricles, and a ventricle with two unequal chambers, which communicate together. The blood from the body enters the right auricle, and that from the lung the left, but the two streams mingle more or less in passing through the ventricle. These reptiles are distinguished by having the body enclosed between two shields or shells, so that the head, neck, legs, and tail only appear externally; and these are capable of being retracted in a greater or less degree. The upper shell is formed by the ribs, which are enlarged, flattened, and closely united by sutures; the under shell is the sternum or breast bone, and the vertebrae of the neck and tail only are movable. In consequence of this conformation, the muscular system is inverted, in many respects, as with insects and *crustaceæ*; and to this circumstance these animals owe their great strength. Tortoises have no teeth; and the margin of the mandibles is covered with horn, as in the beaks of birds. They are very tenacious of life, and will move weeks after being deprived of the head; and this last will continue to bite long after it is severed from the body. They can remain months, and even years, without food. The eggs have a hard shell, and are deposited in the sand. The Land Tortoises are distinguished by the convexity of their upper shell, and their short toes, enveloped in the common integument nearly to the nails. They perish if thrown into the water.

GENUS TESTUDO. — The Land Tortoises. These animals are distinguished by a bulged carapace, which is supported by a solid, bony skeleton; their feet are truncated, with very short toes connected nearly to the nails, and, together with the head, can be wholly withdrawn within the shell. The fore feet have five nails, and the hinder four. They feed chiefly on vegetable substances.

T. Indica. — This species is distinguished by its large size, measuring over three feet in length, and is of a brown color. The Indian species are numerous, and most of them are remarkable for their great strength. Mr. Bell describes one, which he names *Tyrris arachnoides*, that can easily carry two men on its back. The hind legs of this Tortoise bear an extraordinary

resemblance to those of an elephant. The anterior part of the shell is movable on a transverse hinge, and shuts up the head and fore limbs. Slow, quiet, and inoffensive, this reptile seldom wanders far from its haunts, and trusts only to its passive means of defence when molested.

T. Græca.—This animal is about a foot long, and frequents the regions round the Mediterranean; it is also found in other parts of Europe. It lays four or five eggs in spring, and burrows a hole, where it passes the winter. Its food is fruit, leaves, insects, and worms. A specimen resembling this, but a little larger, I have seen in the State of Maine.

T. Radiata.—This species is a native of New Holland. It is of a large size, but otherwise resembles the one mentioned below.

T. Geometrica.—This is a small species, with a black shell, pleasingly relieved with yellow lines radiating from a disk of the same color.

FRESH-WATER TORTOISES.—These do not differ from the above in general characters, with the exception that their feet are more adapted to aquatic habits, and the armor of the back is flatter than in the land tortoises.

T. Picta.—This species is the most widely diffused, and is found on both continents. It is of a brown color, and each scale is encircled with a yellow ribbon. It is common in all parts of North America, and is often seen among reeds, upon rocks, or the trunks of trees, from which it falls into the water when alarmed.

T. Europea inhabits all the south of Europe, and is about ten inches in length. Its flesh is good, on which account it is captured and fattened on bread and tender herbage. According to Morsigni, its egg requires a year to hatch. There are many other species, among which are the well-known Terrapin, or Box-tortoise, and *T. serpentina*, which approximates some of the turtles. It is known by its extremely long tail. "It inhabits the warm regions of North America, is very destructive to fish and water-fowl, ascends far up the rivers, and sometimes attains a weight of twenty pounds."

GENUS CHELONIA.—The Turtles. This family comprises a large number of species, most of them of large size, and many of them valuable for their flesh, which is esteemed a great luxury, and their shells, which are employed in the arts.

The turtles are distinguished from the land tortoises particularly by their large and long fin-shaped feet, and also by a longer tail, which serves them as a rudder. They have no teeth, but the horny upper jaw closes over the lower like the lid of a box, thus serving them as excellent shears, either for crushing shells or dividing the tough fibres of the sea-grass.

They are at home in all the warmer seas, but sometimes they are carried by oceanic streams far away from their accustomed haunts. Thus, in the

year 1752, a Green Turtle, six feet long, and weighing nine hundred pounds, stranded near Dieppe; and in 1778, another, seven feet long, on the coast of Languedoc. One taken on the coast of Cornwall, in July, 1755, measured, from the tip of the nose to the end of the shell, six feet nine inches, and the weight was supposed to be nearly eight hundred pounds. These few examples show us that the turtles rank among the larger inhabitants of the ocean, although they are far from attaining the fabulous proportions assigned to them by Pliny (who makes the Indians use their shells as boats or roofs), or the enormous size of some colossal, extinct species, such as the fossil tortoise from the Sirvala Hills, preserved in the East Indian Museum, which measures twelve feet in length. They live almost constantly at sea on shell-fish, like the fierce Loggerhead Turtle (*C. caretta*), partly on sea-grass, like the Green Turtle (*C. nidas*), and only go on shore during the warmest months of the year for the purpose of laying their eggs.

Chelonia Nidas.—The Edible, or Green Turtle. The shell of this species is distinguished by its greenish scales, to the number of thirty, the medial of which are disposed in almost regular hexagons. The Green Turtle attains a length of six or seven feet, and a weight of seven or eight hundred pounds. The flesh is much esteemed, Green Turtle soup being regarded as a prime luxury by epicures; but the shell is not valuable. It feeds in great troops upon the *algæ*, in the depths of the ocean, and approaches the mouths of rivers to respire. It deposits its eggs in the sand, where the sun may warm them. They are very numerous, and are considered very delicate as food.

C. Maculosa, an allied species, has the middle plates twice as long as wide, and of a fulvous color, marked with large black spots. Another neighboring species, *C. Lachrymata*, has plates, as in the preceding one, but raised into a base posteriorly, with black splashes upon the fulvous. The scales of both of these are used in manufactures.

Prince Maximilian, of Neuwied, furnishes the following interesting description, in his instructive work, entitled *Travels through the Brazils* :—

"We followed the monotonous sea-coast (our two soldiers, a negro and an Indian), frequently stopping to dig turtle eggs out of the sand, which, boiled in sea water, used to form our evening repast. Once, while they were busy gathering drift wood for cooking, we found, but a small distance from our fire, an enormous turtle, busy laying her eggs. We could not possibly have met with anything more agreeable; the creature seemed to have crawled there for the express purpose of providing for our supper. Our presence did not discompose her in the least; she allowed herself to be touched, and even raised from the ground, for which purpose four men were

required. During our loud deliberations on her future fate she gave no other signs of uneasiness than a blowing sound, and continued to work slowly with her hind fins, throwing up the earth at regular intervals.

"One of the soldiers stretched himself out at full length on the ground, near the purveyor of our kitchen, inserted his arm into the earth-hole, and threw out the eggs as they were laid by the turtle. In this manner above a hundred were collected in about ten minutes. A council was now held as to the means of adding the beast to our collection, but, as it would have required an additional mule for the transport, we gave it its life. These colossal turtles—Midas, Coriacea, and Caretta—especially choose these desert coasts for the laying of their eggs. They emerge from the sea in the dusk of evening, and then crawl back again into the water, one or two hours after the setting of the sun. Thus also the friendly turtle, which had so abundantly provided for our wants, disappeared after a short time; we found the large hole filled up, and a broad trace in the sand showed that the animal had again retreated to its favorite element. The Midas is said to lay from ten to twelve dozen, and the Coriacea from eighteen to twenty dozen eggs at once."

C. Imbricata.—This turtle is not so large as the Green, but has a more lengthened muzzle, and the scales, of which there are thirteen, yellowish and brown, cover each other in the manner of tiles. The flesh is not edible, but the eggs are delicate, and the shell is the finest employed in manufactures. It inhabits the seas of all hot climates. The Imbricated Turtle is hunted for its shell, and the Green for its flesh, on which account immense numbers, of both species, are destroyed yearly in various quarters of the globe. The South American shores, those of the West Indies, and of the islands of the Indian seas are visited for this purpose. The gifted author of "Paul and Virginia" draws the following graphic and interesting picture of a turtle hunt on Ascension Island:—

"Fire-wood, kettle, and the neat boat sail were landed, and the sailors lay down to sleep, as the turtles do not emerge from the sea before night-fall. The moon rose above the horizon, and illumined the solitude, but her light, which adds new charms to a friendly prospect, rendered this desolate scene more dreary still. We were at the foot of a black hillock, on whose summit mariners had planted a great cross. Before us lay the plain, covered with innumerable blocks of black lava, whose crests, whitened by the drippings of the sea-birds, glistened in the moonbeam. These pallid heads on dark bodies, some of which were upright, and others reclined, appeared to us like phantoms hovering over tombs. The greatest stillness reigned over this desolate earth, interrupted only from time to time by the breaking of a wave, or the shriek of a sea-bird. We went to the great bay to await

the arrival of the turtles, and there we lay flat upon the sand, in the deepest silence, as the least noise frightens the turtles, and causes them to withdraw, and at last we saw three of them rising out of the water, and slowly creeping on shore, like black masses. We rapidly ran up to the first, but our impatience caused it to drop immediately again into the sea, where it escaped our pursuit. The second, which had already advanced too far, was unable to retreat: we turned it on its back. In this way we caught about fifty turtles, some of which weighed five hundred pounds. Next morning, at ten, the boat came to fetch the produce of our nocturnal sport. This work occupied us the whole day, and in the evening the superfluous turtles were restored to the sea. If suffered to remain a long time on their backs, their eyes become blood-red, and start out of their sockets. We found several on the strand, that had been allowed to perish in this position — a cruel negligence, of which sailors are but too often guilty."

But other foes, besides man, make war upon the poor turtles, and persecute them to death. Large numbers of these animals annually frequent the wild sand-coast of Bantam (Java). They are often obliged to creep over nearly a quarter of a mile of the beach before finding at the foot of the sand-dunes dry and loose soil fit for their purpose; and on this journey, which for them is a very long one, they have many dangers to encounter. Hundreds of their skeletons lie scattered about the strand, many of them five feet long, and three feet broad; some bleached and cleaned by time, others still half filled with putrid intestines, and others, again, quite fresh and bleeding. High in the air a number of birds of prey wheel about, scared by the traveller's approach. Here is the place where the turtles are attacked by the wild dogs. In packs of from twenty to fifty, the growling rabble assails the poor sea-animal at every accessible point, gnaws and tugs at the feet and at the head and succeeds, by united efforts, in turning the huge creature upon its back. Then the abdominal scales are torn off, and the ravenous dogs hold a bloody meal on the flesh, intestines, and eggs of their defenceless prey. Sometimes, however, the turtle escapes their rage, and, dragging its lacerating tormentors along with it, succeeds in regaining the friendly sea. Nor do the dogs always enjoy an undisturbed repast. Often, during the night, the hungry tiger bursts out of the forest, pauses for a moment, casts a glance over the strand, approaches slowly, and then, with one bound, accompanied by a terrific roar, springs among the dogs, scattering the howling band like chaff before the wind. And now it is the tiger's turn to feast; but even he, though rarely, is sometimes disturbed by man. Thus, on this lonely, melancholy coast, wild dogs and tigers wage an unequal war with the inhabitants of the ocean.

C. Caretta.—The Hawk-billed Turtle. A color more or less rufous or

brown, and fifteen scales, the medial of which have raised crests, are the principal characters of the species. It is an inhabitant of various seas, but has little commercial value, as the flesh and shell are worthless. It furnishes, however, a considerable quantity of oil, nearly equal in quality to that of the whale, and which may be applied to the same uses.

GENUS SPHARGIS.—The Leather-backs. This series comprises those species which have no scales, but have the carapace, or upper armor, clad in a kind of leather. There are but two or three species mentioned.

GENUS CHELYS.—The Chelydes, as these turtles are called, have an envelope much too small to enclose all their limbs; their nose is prolonged into a little trunk; but their most prominent character is a widely-eleft mouth, destitute of the horny beak which distinguishes other genera.

GENUS TRIONYX.—The Soft Tortoise. The Soft Tortoises have no scales, but both the carapace and plastron are enveloped in a soft skin. The horn of their beak is invested with fleshy lips outside, and their nose is prolonged, as in the Chelydes. They dwell in fresh water.

T. Triunguis.—This species inhabits the northern portions of Africa, and is sometimes three feet long. It is of a green color, spotted with white. It destroys large numbers of young crocodiles, and thus renders an important service to the Egyptians.

T. Ferox.—The American Trionyx. The rivers of Carolina, Georgia, Florida, and Guiana are the *habitat* of this animal. While it devours young alligators, it often falls a prey to the older ones. It seizes on birds and reptiles, for which it lies in ambuscade among the weeds. Its flesh is palatable and wholesome.

The turtle, being cold-blooded, is obliged to confide the hatching of her eggs to the sun, which generally accomplishes the task in three weeks. On creeping out of the egg, the young, even those of the largest species, are not larger than half a crown, and of a white color. Unprotected by a parent's tenderness, the poor little creatures seem only to be born for immediate death. Their first instinctive movements are towards the element for which they are destined; slowly they drag themselves towards the water, but the sea meets them with a rough embrace, and the unmerciful waves generally throw them back again upon the shore. Here they are attacked by great sea-birds, storks, and herons, against which, in spite of their smallness, they make feeble efforts of defence or by still more powerful beasts of prey; and thus the greater part of the unfortunate brood is destroyed at its very first entrance into life, while those which reach the sea are generally devoured by sharks and other sharp-toothed fishes. It is, therefore, not in vain that the turtle lays four or five hundred eggs in a single summer, for, were she less fruitful, the race would long since have been extinguished.

ORDER II. SAURIA (Crocodiles, Alligators, Lizards).

The animals included in this order are all of lizard shape, and vary in size, from the gigantic Crocodile, which often attains the length of thirty feet, to insignificant creatures of a few inches. They have a heart constituted like that of the Chelonians; lungs, which extend towards the hinder part of the body; mouths invariably armed with teeth; tails more or less lengthened, and thick at the base, and skins covered with thick, hard, serrated scales, or scaly granules. Most of the Saurians have four legs, but some have only two. Their eggs are enclosed in a hard envelope, and the forms of the young are perfectly developed before they issue therefrom.

In a former period of the earth the Saurians peopled the vast abysses of the ocean, and individuals, like the Ichthyosaurus, huge and rapacious monsters, ruled the seas, remorseless tyrants of all the other inhabitants of the deep. But changes in the temperature of the elements have swept them from the scene of existence, and it is from fossil remains only that we gather the story of their life and mode of living. No members of this race now frequent the sea, but the larger representatives of this once formidable family now inhabit the lagoons, rivers, and swamps of tropical climates, while the others are distributed over the whole surface of the globe, with the exception of the frozen regions. The order is divided into six families, the first of which comprises the Crocodiles and Alligators.

GENUS CROCODILUS.—Brongniart. The Crocodile is a gigantic beast, of prodigious strength, found in the rivers of the warm regions of the Eastern Continent, especially in the Nile and Niger. The back and tail are covered with great square scales, constituting an armor of extraordinary strength, and the jaws are furnished with a row of pointed teeth. It often reaches the enormous length of thirty feet, and will sometimes seize the most powerful animals, such as the tiger, and draw them under the water. Yet it is affirmed that this formidable monster may be tamed, and made to serve its master with the obedience of the ox. In Siam, the Crocodile is taken when young, subjected to discipline, and managed "like a horse, the rider directing it as he thinks proper." This subjugation of the Crocodile to human control is confirmed by travellers who have had opportunities of observing the strange spectacle. The author of *Dry Leaves from Young Egypt* relates the following adventure:—

"One of my first exhibitions, after reaching Karachi, was a visit to the Magar Talao, as it is called, or *Lake of Crocodiles*. This curious place is about eight miles from Karachi, and is well worth inspecting to all who are

fond of the monstrous and grotesque. A moderate ride through a sandy and sterile track, varied with a few patches of jungle, brings one to a grove of tamarind trees, hid in the bosom of which lie the grisly brood of monsters. Little would one, ignorant of the *locale*, suspect that, under that green wood, in that tiny pool, which an active leaper could half spring across, such hideous denizens are concealed. ‘Here is the pool,’ I said to my guide, rather contemptuously, ‘but where are the crocodiles?’ At the same time I was stalking on very boldly, with head erect, and rather inclined to flout the whole affair, *naso adunco*. A sudden hoarse roar or bark, however, under my very feet, made me execute a pirouette in the air with extraordinary adroitness, and, perhaps, with more animation than grace. I had almost stepped on a young crocodilian imp, about three feet long, whose bite, small as he was, would have been the reverse of pleasant. Presently the genius of the place appeared in the shape of a wizard-looking old fakir, who, on my presenting him with a couple of rupees, produced his wand (in other words, a long pole), and then proceeded to call up his spirits. On his shouting, ‘Ao! Ao!’ (Come! Come!), two or three times, the water suddenly became alive with monsters. At least threescore huge crocodiles, some of them fifteen feet in length, made their appearance, and came thronging to the shore. The whole scene reminded me of fairy tales. The solitary wood, the pool, with its strange inmates, the fakir’s lonely hut on the hillside, the fakir himself, tall, swart, and gaunt, the rubber-looking Biluchi by my side, made up a fantastic picture. Strange, too, the control our showman displayed over his ‘lions.’ On his motioning with the pole, they stopped (indeed, they had already arrived at a disagreeable propinquity), and on his calling out, ‘Baitho’ (Sit down), they lay flat on their stomachs, grinning horrible obedience with their open and expectant jaws. Some large pieces of flesh were thrown to them, to get which they struggled, writhed, and fought, and tore the flesh into shreds and gobbets. I was amused with the respect the smaller ones showed to their overgrown seniors. One fellow, about ten feet long, was walking up to the feeding-ground from the water, when he caught a glimpse of one much larger just behind him. It was odd to see the frightened look with which he sidled out of the way, evidently expecting to lose half a yard of his tail before he could effect his retreat. At a short distance (perhaps half a mile) from the first pool I was shown another, in which the water was as warm as one could bear it for complete immersion; yet, even here, I saw some small alligators. The fakirs told me these brutes were very numerous in the river, about fifteen or twenty miles to the west. The monarch of the place, an enormous crocodile, to whom the fakir had given the name of ‘Mor Sahib’ (My Lord Mor), never obeyed the call to come out. As I walked round the pool, I was

shown where he lay, with his head above water, immovable as a log, and for which I should have taken him but for his small, savage eyes, which glittered so that they seemed to emit sparks. He was, the fakir said, very fierce and dangerous, and at least twenty feet in length."

There are several species of crocodiles peculiar to Africa and Asia, but in characters and habits they do not materially differ from the Crocodile of the Nile. That of the Ganges, however, "which attains a large size, is remarkable not only for the length of its muzzle, but for a large cartilaginous prominence surrounding the nostrils, which throws these backwards, and led Elian to assert that the Gangetic Crocodile had a horn at the tip of its snout."

The crocodiles are carnivorous, but unable to swallow under water, and their habit is to drown their prey, and conceal it in some hole beneath the surface till it putrefies, when they devour it. The female is very prolific, guards her eggs with care, and continues to protect her young until they can support themselves. Yet, with all her vigilance, she cannot prevent the greater portion of her eggs from being devoured by the ichneumon, trionyx, and vulture. Were it not for this provision of nature, these frightful animals would overrun the countries which they frequent, and render them uninhabitable by human beings.

GENUS ALLIGATOR. — Cuvier: The American Crocodile. — The Cayman. This animal is distinguished from its Oriental congener by a broader and more obtuse muzzle, and feet undentated, and only semi-palmated. These powerful animals are found in great numbers in lagoons and rivers of Georgia, Florida, and most of the warmer countries of the American Continent. Their body is as large as that of the horse, and in shape is not unlike that of the lizard: their head is described as resembling a "large clump of wood floating about upon the water." They grow to the length of fifteen or twenty feet, are covered by a dense harness of horny scales, impenetrable to a musket ball, except about the head and shoulders, and have a huge mouth, opening about three feet, armed with two rows of strong, unequal, conical teeth, some of which shut into cavities of the upper jaw-bone. They swim or dart along through the water with wonderful celerity, impelled by their long, laterally-compressed, and powerful tails, which serve as very efficient oars. On land, their motions are proportionally slow and embarrassed, because of the length and unwieldiness of their bodies, the shortness of their limbs, and the sort of small, false ribs which reach from joint to joint of their necks, and render lateral motion very difficult. The Alligator is generally considered as disposed to retire from man, but this is only to be understood of alligators frequenting rivers or waters where they are often disturbed. In situations less visited by man, they are

very ferocious. They have a loud and terrible roar, resembling distant thunder; and when hundreds of them are roaring together, it seems as if the earth itself were agitated. They also make a remarkable noise by clapping their jaws together, which may be heard at a great distance. These animals may often be seen lying in great numbers upon the banks, where they seize hogs and other beasts which go to the river to drink. Sometimes they attack small boats, endangering the lives of those who are in them.

"The females make their nests in a curious manner upon the banks of rivers or lagoons, generally in marshes, along which, at a short distance from the water, the nests are arranged somewhat like an encampment. They are obtuse cones, four feet high, and about four feet in diameter at the base, built of mud and grass. From one hundred to two hundred eggs are found in each one. The females keep near the nests, and take the young under their care as soon as they are hatched, defending them with great perseverance and courage. The young are seen following the mother through the water like a brood of chickens following a hen. When basking in the sun on shore, the young are heard whining and yelping about the mother, not unlike young puppies. When first hatched they are very feeble and helpless, and large numbers of them are devoured by beasts of prey, turtles, and the American trionyx, as well as by the male alligators, until they grow old and strong enough to defend themselves. Many of the eggs, also, are destroyed by vultures and other animals, so that the race would become speedily extinct were it not for the great fecundity of the females."

THE SECOND FAMILY OF THE SAURIANS embraces the Lizards, divided into two great genera, comprising numerous species. Besides the common and well-known individuals of the Lizard group, there are the Monitors, which are the largest of the whole tribe. They have teeth in both jaws, and are adapted to aquatic habits. Frequenting the vicinity of the haunts of crocodiles and alligators, it is said that they give warning, by a whistling sound, of the approach of those dangerous reptiles, and hence probably their names of *Sauvegarde* and *Monitor*. They constitute the genus *Monitor*, one species of which, *M. crocodilinus* (the Great Dragonet of Guiana), attains a length of six feet, and is eaten. Another, of equal size and length, is found in Brazil. It runs swiftly on the ground, and takes to the water when pursued, into which it plunges, but does not swim. It devours all sorts of insects, small reptiles, and the eggs of poultry, and nestles in holes which it burrows in the sand. Its flesh and eggs are eaten by the natives, and considered wholesome and savory.

THE THIRD FAMILY OF SAURIANS is composed of the Iguana group. In this series is the Dragon, a small animal, furnished with a sort of membrane or wing, which enables it to glide from bough to bough, and is the

original of the flying serpents of the ancient mythology. Here also is found the Marbled, which, having a voluminous lung that fills nearly the whole body, changes the hues of its skin, when excited, like the chameleon.

THE FOURTH FAMILY OF SAURIANS is composed of the *Geckotians*, small animals of nocturnal habits and disagreeable aspect, bearing a considerable resemblance to toads and salamanders. Their feet are so constructed that they adhere to surfaces, and enable the animal to walk on ceilings. They belong to the Old World.

THE FIFTH FAMILY consists of the Chameleons. These singular animals are about fifteen inches in length: they live on trees, subsisting on insects, which they dexterously capture with their long, extensible tongue, that moves with great celerity. The end of this organ is furnished with a glutinous substance, which attracts numerous small insects, and holds them fast till they are conveyed to the mouth and swallowed, when the curiously-armed tongue again darts forth for another batch of victims.

The lung of the Chameleon is so vast that, when inflated, the body appears transparent, which led the ancients to believe that these animals fed on air. The singular power they possess of changing their color according to their wants and passions, is also to be attributed to this magnitude of the lung. Another remarkable peculiarity of this reptile is the want of sympathy between the two sides of the whole body, each side having movements and affections of its own, like a separate animal. Thus, while one side may be asleep, the other may be awake; one may be of one color, and the other of another; the eyes, too, have separate movements, and the limbs will not act in concert; consequently the animal cannot swim.

THE SIXTH FAMILY comprises the *Sciniodoliens*, which are recognized by the shortness of their feet, the non-extensibility of the tongue, and the equality of the tile-like scales which cover the whole body and tail. In the whole family there is a general approach to the serpent form. It is divided into five genera, viz., the *Sinques*, the *Seps*, the *Dipodes*, the *Chalciodes*, and the *Chirotes*, all of which exhibit the same gradual descent to the serpent character.

ORDER III. OPHIDIA (Serpents).

The first family of Serpents retains the skull, teeth, and tongue of one of the preceding groups,—the *Seps*,—and might be designated as Saurians without feet. The *Double Marcheurs* (Ophidians that can progress either head or tail foremost), the *Amphisbenes*, the *Typhlops*, the *Roles*, which comprise the first part of the second family of Serpents, also show

some Saurian characters. They are, for the most part, very small animals, and offer no peculiarities of sufficient interest to be recorded here.

SERPENTS PROPER. "What geology and anatomy have unfolded of the nature of Serpents, in regard to their present condition," says Professor Owen, "amounts to this: that their parts are as exquisitely adjusted to the form of the whole, and to their habits and sphere of life, as is the organization of any animal which we call superior to them. It is true the Serpent has no limbs, yet it can outclimb the monkey, outswim the fish, outleap the jerboa, and, suddenly loosing the coils of its crouching spiral, it can spring into the air, and seize the bird upon the wing; thus all these creatures fall its prey. The Serpent has neither hands nor talons, yet it can outwrestle the athlete, and crush the tiger in its folds. Far from licking up its food as it glides along, the Serpent lifts up its crushed prey, and presents it, grasped in the death-coil as in the hand, to the gaping, slime-dropping mouth. It is truly wonderful to see the work of hands, feet, fins, performed by a simple modification of the vertebral column in a multiplication of its joints, with mobility of its ribs. As Serpents move chiefly on the surface of the earth, their danger is greatest from pressure or blows from above; all the joints are accordingly fashioned to resist yielding, and to sustain pressure in a vertical direction; there is no natural undulation of the body upwards and downwards—it is permitted only from side to side. So closely and compactly do the ten pairs of the joints between each side of the two or three hundred vertebrae fit together, that, even in a relaxed and dead state, the body cannot be twisted, except in a series of side coils. Of this the reader may assure himself by an experiment on a dead and supple snake. Let him lay it straight along a level surface, seize the end of the tail, and, by a movement of rotation between the thumb and finger, endeavor to screw the snake into spiral coils; before he can produce a single turn, the whole of the long and slender body will roll over as rigidly as if it were a stick. When we call to mind the anatomical structure of the skull, the singular density and structure of the bones of the cranium strike us as a special provision against fracture and injury to the head. And when we consider the remarkable manner in which all the bones of the skull overlap one another, we cannot but discern a special adaptation in the structure of Serpents to their commonly prone position, and a provision for the dangers to which they were subject from falling bodies, and the tread of heavy beasts."

With respect to their conformation, all Serpents have a very wide mouth in proportion to the size of the head; and, what is very extraordinary, they can gape and swallow the head of another animal which is three times as big as their own. To explain this, it must be observed, that the jaws of

this animal do not open as ours, in the manner of a pair of hinges, where bones are applied to bones, and play upon one another; on the contrary, the Serpents jaws are held together at the roots by a stretching, muscular skin; by which means they open as widely as the animal chooses to stretch them, and admit of a prey much thicker than the snake's own body. The throat, like stretching leather, dilates to admit the morsel; the stomach receives it in part, and the rest remains in the gullet till putrefaction and the juices of the Serpent's body unite to dissolve it.

The tongue in all these animals is long and forked. It is composed of two long, fleshy substances, which terminate in sharp points, and are very pliable. Some of the viper kind have tongues a fifth part the length of their bodies; they are continually darting them out, but they are entirely harmless, and only terrify those who are ignorant of the real situation of their poison.

The skin is composed of a number of scales, united to each other by a transparent membrane, which grows harder as it grows older, until the animal changes it, which is generally done twice a year. This cover then bursts near the head, and the Serpents creep from it, by an undulatory motion, in a new skin much more vivid than the former. As the edges of the foremost scales lie over the ends of the following scales, so those edges, when the scales are erected, catch in the ground, like the nails in the wheels of a chariot, and so promote and facilitate the animal's progressive motion. The erecting these scales is by means of a multitude of distinct muscles, with which each is supplied, and one end of which is tacked to the foregoing.

This tribe of animals, like that of fishes, seems to have no bounds put to its growth; their bones are in a great measure cartilaginous, and they are consequently capable of great extension; the older, therefore, a Serpent becomes, the larger it grows; and, as they seem to live to a great age, they arrive at an enormous size.

Lequat assures us that he saw a Serpent in Java that was fifty feet long, and Carli mentions their growing to above forty feet. Mr. Wentworth, who had large concerns in South America, assures us that, in that country, they grow to an enormous length. He one day sent out a soldier, with an Indian, to kill a wild fowl for the table; and they accordingly went some miles from the fort. In pursuing their game, the Indian, who generally marched before, beginning to tire, went to rest himself upon the fallen trunk of a tree, as he supposed it to be; but when he was just going to sit down, the enormous monster began to move, and the poor savage, perceiving that he had approached a liboya, the greatest of all the Serpent kind, dropped down in an agony. The soldier, who perceived at some distance what had

happened, levelled at the Serpent's head, and, by a lucky aim, shot it dead; however, he continued his fire until he was assured that the animal was killed; and then, going up to rescue his companion, who was fallen motionless by its side, he, to his astonishment, found him dead likewise, being killed by the fright.

Upon his return to the fort, and telling what had happened, Mr. Wentworth ordered the animal to be brought up, when it was measured, and found to be thirty-six feet long.

In the East Indies they grow also to an enormous size, particularly in the Island of Java, where we are assured that one of them will destroy and devour a buffalo. In a letter printed in the German Ephemerides, we have an account of a combat between an enormous Serpent and a buffalo, by a person who affirms that he was himself a spectator. The Serpent had, for some time, been waiting near the brink of a pool in expectation of its prey, when a buffalo was the first that offered. Having darted upon the affrighted animal, it instantly began to wrap it round with its voluminous twistings; and at every twist the bones of the buffalo were heard to crack almost as loud as the report of a cannon. It was in vain that the poor animal struggled and bellowed; its enormous enemy entwined too closely to get free; till at length, all its bones being mashed to pieces, like those of a malefactor on the wheel, and the whole body reduced to one uniform mass, the Serpent untwined its folds to swallow its prey at leisure. To prepare for this, and, in order to make the body slip down the throat more readily, it was seen to lick the whole body over, and thus cover it with its mucus. It then began to swallow it at that end that offered least resistance, while its length of body was dilated to receive its prey, and thus took in at once a morsel that was three times its own thickness. We are assured by travellers, that these animals are often found with the body of a stag in their gullet, while the horns, which they are unable to swallow, keep sticking out at their mouths.

But it is happy for mankind that the rapacity of these frightful creatures is often their punishment; for whenever any of the Serpent kind have gorged themselves in this manner, and their body is seen particularly distended with food, they become torpid, and may be approached and destroyed with safety.

Other creatures have a choice in their provision; but the Serpent indiscriminately preys upon all—the buffalo, the tiger, and the gazelle. One would think that the porcupine's quills might be sufficient to protect it; but whatever has life serves to appease the hunger of these devouring creatures. Porcupines, with all their quills, have frequently been found in their stomachs when killed and opened; nay, they most frequently are seen to devour each other.

But though these animals are, above all others, the most voracious, and, though the morsel which they swallow, without chewing, is greater than what any other creature, either by land or water, the whale itself not excepted, can devour, yet no animals upon earth bear abstinence so long as they. A single meal, with many of the snake kind, seems to be the adventure of a season; and is an occurrence for which they have been for weeks, nay, sometimes for months, in patient expectation. Their prey continues, for a long time, partly in the stomach, partly in the gullet, and a part is often seen hanging out of the mouth. In this manner it digests by degrees, and, in proportion as the part below is dissolved, the part above is taken in. It is not, therefore, till this tedious operation is entirely performed, that the Serpent renews its appetite and its activity. But, should any accident prevent it from issuing once more from its cell, it still can continue to bear famine for weeks, months, nay, for years, together. Vipers are often kept in boxes for six or eight months without any food whatever; and there are little Serpents sometimes sent to Europe from Grand Cairo that live for several years in glasses, and never eat at all, nor even stain the glass with their excrement. Thus the Serpent tribe unite in themselves two very opposite qualities — wonderful abstinence and yet incredible rapacity.

Though all Serpents are amphibious, some are much fonder of the water than others; and, though destitute of fins or gills, remain at the bottom, or swim along the surface, with great ease. They can, however, endure to live in fresh water only; for salt is an effectual bane to the whole tribe.

Some Serpents have a most horrible fætor attending them, which is alone capable of intimidating the brave. This proceeds from two glands near the vent, like those in the weasel or polecat; and, like those animals, in proportion as they are excited by rage or by fear, the scent grows stronger. It would seem, however, that such Serpents as are most venomous are least offensive in this particular, since the rattlesnake and the viper have no smell whatever; nay, we are told that, at Calcutta and Crangamore, in the East Indies, there are some very noxious Serpents, who are so far from being disagreeable that their excrements are sought after, and kept as the most pleasing perfume. The Esculapian Serpent is also of this number.

Some Serpents bring forth their young alive, as the viper. Some bring forth eggs, which are hatched by the heat of their situation, as the common black snake, and the majority of the Serpent tribe. When a reader, ignorant of anatomy, is told that some of these animals produce their young alive, and that some produce eggs only, he is apt to suppose a very great difference in their internal conformation, which makes such a variety in their manner of bringing forth. But this is not the case; these animals are internally alike in whatever manner they produce their young; and the

variety of their bringing forth is rather a slight than a real discrimination. The only difference is, that the viper hatches her eggs, and brings them to maturity within her body; the snake is more premature in her productions, and sends her eggs into the light some time before the young ones are capable of leaving the shell. Thus, if either are opened, the eggs will be found in the womb, covered with their membranous shell, and adhering to each other like large beads on a string. In the egg of both, the young ones will be found, though at different stages of maturity; those of the viper will crawl and bite, the moment the shell that encloses them is broken open; those of the snake are not yet arrived at their perfect form.

Father Labat took a Serpent, of the viper kind, that was nine feet long, and ordered it to be opened in his presence. He then saw the manner in which the eggs of these animals lie in the womb. In this creature there were six eggs, each of the size of a goose egg, but longer, more pointed, and covered with a membranous skin, by which also they were united to each other. Each of these eggs contained from thirteen to fifteen young ones, about six inches long, and as thick as a goose quill. These little, mischievous animals were no sooner let loose from the shell, than they crept about, and put themselves into a threatening posture, coiling themselves up, and biting the stick with which he was destroying them. In this manner he killed seventy-four young ones; those that were contained in one of the eggs escaped at the place, where the female was killed, by the bursting of the egg, and their getting among the bushes.

The last distinction that we shall mention, but the most material among Serpents, is, that some are venomous, and some inoffensive; but not above a tenth of their number are actually venomous.

From the noxious qualities in the Serpent kind, it is no wonder that not only man, but beasts and birds, carry on an unceasing war against them. The ichneumon of the Indians, and the peccary of America, destroy them in great numbers. These animals have the art of seizing them near the head; and it is said that they can skin them with great dexterity. The vulture and the eagle also prey upon them in great abundance; and often, sousing down from the clouds, drop upon a long Serpent, which they snatch, struggling and writhing, in the air. Dogs, also, are bred up to oppose them.

Father Feuillée tells us that, being in the woods of Martinico, he was attacked by a large Serpent, which he could not easily avoid, when his dog immediately came to his relief, and seized the assailant with great courage. The Serpent entwined him, and pressed him so violently, that the blood came out of his mouth, and yet the dog never ceased till he had torn it in pieces. The dog was not sensible of his wounds during the fight; but, soon after, his head swelled prodigiously, and he lay on the ground as dead. But

his master having found, hard by, a banana tree, he applied its juice, mixed with treacle, to the wound, which recovered the dog, and quickly healed his sores.

In India there is nothing so common as dancing Serpents, which are carried about in a broad, flat vessel somewhat resembling a sieve. These erect and put themselves in motion at the word of command. When their keeper sings a slow tune, they seem, by their heads, to keep time; when he sings a quicker measure, they appear to move more brisk and lively. All animals have a certain degree of docility; and we find that Serpents themselves can be brought to move and approach at the voice of their master. From this trick, successfully practised before the ignorant, it is most probable has arisen all the boasted pretensions which some have made to the charming of Serpents—an art to which the native Americans pretend at this very day.

As a general thing, the non-venomous Serpents have the branches of the upper jaw furnished throughout their length, like those of the lower jaw and the palate, with fixed and solid teeth. There are three or four sub-equal ranges of these teeth in the upper part of the mouth, and two in the lower. On the contrary, the venomous Serpents are furnished with movable fangs. It should be remembered, however, that some snakes with solid teeth are exceedingly poisonous, especially those that have very large, black molars.

GENUS BOA.—The Boas. These are the largest of all serpents, attaining a length of from thirty to forty feet. They have a hook on each side of the anus, a compressed body, large towards the middle, small scales on the hinder part of the head, and a prehensile tail. They are capable of swallowing very large animals, even cattle, after having crushed them within their folds, and lubricated, with their saliva, as we have already described in our general remarks upon serpents. To enable them to perform such an extraordinary feat of deglutition, they have, at the extremity of the great lung,—one lung is but half the length of the other,—a large air-bag, which contains the air requisite for respiration when the nostrils are closed in the process of swallowing.

There are several species, which are distinguished by the difference in the teguments of the head and jaws. The Anaconda of South America does not differ materially from the Boa of Africa and India. They are all powerful animals, and justly objects of terror to the inhabitants of those countries which are infested by them.

All along the swampy banks of the Rivers Niger and Oroonoko, where the sun is hot, the forests thick, and the men but few, the serpents cling among the branches of the trees in infinite numbers, and carry on an unceasing war against all other animals in their vicinity. Travellers have assured us that they have often seen large snakes twining around the trunk

of a tall tree, encompassing it like a wreath, and thus rising and descending at pleasure. In these countries, therefore, the serpent is too formidable to become an object of curiosity, for it excites much more violent sensations.

We are not, therefore, to reject, as wholly fabulous, the accounts left us by the ancients of the terrible devastations committed by a single serpent. It is probable, in early times, when the arts were little known, and mankind were but thinly scattered over the earth, that serpents, continuing undisturbed possessors of the forest, grew to an amazing magnitude; and every other tribe of animals fell before them. We have many histories of antiquity presenting us such a picture, and exhibiting a whole nation sinking under the ravages of a single serpent. We are told that while Regulus led his army along the banks of the River Bagrada, in Africa, an enormous serpent disputed his passage over. We are assured by Pliny, who says that he himself saw the skin, that it was a hundred and twenty feet long, and that it had destroyed many of the army. At last, however, the battering engines were brought out against it, and these assailing it from a distance, it was soon destroyed.

GENUS COLUBER.—The Snakes proper. In this division are the Pythons, which have hooks on each side of the anus, and narrow, ventral plates, as in the Boas, from which they only differ by having the plates underneath the tail double. Some of the species equal the Boa in size. Nine or ten different groups are mentioned by the authors, peculiar to the several regions of the earth; but, as they offer no features of special interest, we pass them by.

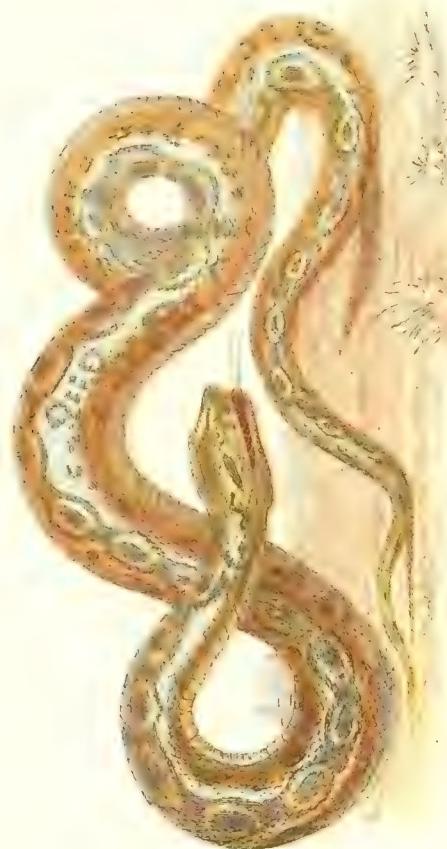
The common *Snakes* of the United States form quite a numerous family. A small species, with a brown back and vermillion belly, is common throughout New England, as is also another, a little larger, colored a beautiful green. The *Striped Snakes*, some of which attain the length of a yard, are too well known to need any description. They are all harmless. Of the *Black Snakes*, two species occur frequently in all parts of this country,—the common *Black*, and the *Collared Black, Snake*, the last mentioned being the most fierce and powerful. It sometimes, when disturbed, will attack human beings, but is scarcely able to contend with a resolute man, although instances have occurred of some severe contests. The Black Snakes move with amazing celerity, the eye being scarcely able to follow them. As they are not poisonous, they can be dangerous only to children, whom sometimes they strangle, by coiling round the neck.

THE VENOMOUS SERPENTS.—All of the species bring forth their young alive, whence the general name, *viper*—a contraction of viviparous. Their maxillary bones are small, and very movable, having a pointed tooth attached to them, through which extends a small canal, which conveys a venomous

liquid, secreted by a large gland beneath the eye. It is this liquid which is instilled into the wound inflicted by the tooth, that produces the effects more or less deadly, according to the species from which it proceeds.

"Venomous serpents, with isolated fangs, present nearly the same external characters; but the greater number have extremely dilatable jaws, and the tongue very extensible. Their head, which is wide posteriorly, has, in general, a savage aspect, which, to a certain extent, announces their ferocity. They form two great genera,—the Rattlesnakes and the Vipers."

GENUS *CROTALUS*, Linn.—These snakes, so celebrated for the deadliness of their venom, are exclusively American. They were formerly very numerous in all the Eastern States, but are now nearly exterminated. This reptile is one of the most dangerous of its family, its bite, properly inflicted, being sure to cause the death of the largest animal. It is totally unknown in the Old World, and is readily distinguished by its rattle—an instrument situated at the tail extremity, and consisting of several horny, membranous cells, which rattle upon each other when agitated by the animal. The Rattlesnake is of a tawny and black color above, and ash color beneath; has a short and rather round head; a large protecting scale over each eye, and long, sharp-pointed fangs. It is slow in its motions, inactive in its habits, and not readily disturbed—features which luckily tend to lessen the mischief which otherwise it would be capable of inflicting. Its head is broad, triangular, and generally flat in its entire extent. Its eyes are very brilliant, and provided with a nictitating membrane, the mouth very large, the tongue forked at its extremity. Its body is robust, elongated, cylindrical, covered above with carinated scales. Its tail is short, cylindrical, and somewhat thick. The number of the little bells, which terminate it, increases with age, an additional one being formed at every casting of the skin. These bells are truncated, quadrangular pyramids, received within each other in such a manner that only a third part of each is visible, the tip of every bone running within two of the bones below it. Thus they are united by a kind of ball and socket joint, and move with a rattling sound whenever the animal agitates its tail. The noise resembles that made by rumpled parchment, or two quills of a goose rubbed smartly against each other. The poison fangs are traversed by a canal for the emission of the poison. These fangs, when not used, remain concealed in a fold of the gum; when the animal bites, the fangs are raised. They are two in number, one at each end of the upper jaw. The effects of the poison of course depend much upon the season of the year, the age, and strength of the reptile, and the part struck; hence numerous cases are on record of individuals recovering in a few weeks from the bite of a Rattlesnake. It is also found, by experiment, that the effect of subsequent wounds is greatly diminished, either by the diminution



Python reticulatus



Python molurus



Python regius

U.S.A. India, Ceylon, Malaya

of the quantity of venom, or by some deterioration of its strength; so that if a venomous serpent be made repeatedly to inflict wounds, without allowing sufficiently long intervals for it to recover its powers, each successive bite becomes less and less dangerous. "A gentleman of my acquaintance," says the author of *British Reptiles*, "had, some years ago, received a living Rattlesnake from America. Intending to try the effects of its bite upon some rats, he introduced one of these animals into the cage with the serpent; it immediately struck the rat, which died in two minutes. Another rat was then placed in the cage; it ran up to the part farthest from the serpent, uttering cries of distress. The snake did not immediately attack it; but, after half an hour, and on being irritated, it struck the rat, which did not exhibit any symptoms of being poisoned for several minutes, and died twenty minutes after the bite. A third and remarkably large rat was then introduced. It exhibited no sign of terror at its dangerous companion, which, on its part, appeared to take no notice of the rat. After watching for the rest of the evening, my friend retired, leaving the serpent and the rat together. On rising early the next morning to ascertain the fate of his two heterogeneous prisoners, he found the snake dead, and the muscular part of its back eaten by the rat. I do not remember at what time of the year this circumstance took place, but I believe it was not during very hot weather."

When the winter is rigorous, the Rattlesnakes pass some time in a lethargic state, near the sources of rivers, in covert places, where the frost cannot reach them. They bury themselves thus, before the autumnal equinox, after they have changed their skin, and do not emerge until after the vernal equinox. Many of them are often found together in the same hole. Till the month of July their bite is comparatively harmless. At Cayenne, and in the hot latitudes, they are in constant activity all the year. They are viviparous, and can live a long time. Some have been mentioned as having forty or fifty pieces in their rattles, and being from eight to ten feet in length. They have great tenacity of life. They feed on birds, squirrels, frogs, &c., and it was for a time believed that they had the power to *charm* these animals, and thus draw them within their reach. Other serpents, also, have been supposed to possess the same wonderful faculty, to which, it was believed, even human beings sometimes succumbed. These small animals, and even timid persons, may have been temporarily paralyzed by fear at the sudden appearance of one of these frightful reptiles, but we are obliged to believe all the cases of *charming*, which are recorded, to be purely imaginative and apocryphal.

A species of horned Rattlesnake has been discovered in the Rocky Mountains. A specimen is now (1869) in the possession of Mr. James Estes, of Jonesboro', Tennessee. It has twelve rattles, a large, flat, red head, and

is about three feet in length. There are two large horns situated on the top of the head—three spikes to each horn.

Allied to the foregoing are the *Trigonocephali*, which are distinguished by the absence of the rattle, but accord in other characteristics. The Copper-head, or Moccasin Snake, belongs to the same family. It inhabits the vast prairies of the West, and we have seen it in Connecticut, at the foot of a mountain, in the town of Southington. Its venom is similar to that of the Rattlesnake. Various remedies have been named as effectual for the bite of these serpents,—such as whiskey taken to intoxication; applying to the wound bruised plantain leaves, or a decoction of tobacco; washing it with strong ley water; a treatment producing a heavy perspiration, as the steam-bath; and, lastly, extracting the virus by suction.

GENUS VIPERA.—The Vipers. These reptiles are distinguished from the Rattlesnakes by the absence of the rattle, and also of the cavities beneath the nostrils, in which last particular they differ from the *Trigonocephali*.

The American Viper, or Adder, is distinguished by its thick body as compared with its length, which is from one to two feet, although we have seen specimens a yard long. Its color is generally brown, with yellow spots; we have met with Adders of a yellowish-white ground color, with black, irregular patches. They are all poisonous, disgusting creatures, and fortunately, in New England at least, nearly exterminated. The celebrated and well known (by the full and frequent descriptions of travellers) *Cobra di Capello*, or dancing serpent of India, and the *Hajj*, or Asp of Egypt, belong to this group. There are several others, all extremely venomous. There are two other species peculiar to India—the *Bongars* and the *Hydras*. The former attain a length of eight or ten feet, and are called Rock-Snakes; the latter are aquatic animals, and infest the Indian seas. They are swift swimmers, feed on fishes, and are extremely poisonous.

The Order of Ophidians terminates with a curious genus of animals, the anatomical and physiological structure of which approximates them to the Batrachians. Their eyes are excessively small, nearly hidden by the skin, and sometimes wholly absent, whence their generic name, *CÆCILIA*. They inhabit the warm regions of both continents, and live, for the most part, beneath the surface, sometimes in marshy places several feet under ground. One species, the *C. lumbricoides*, is totally blind, two feet in length, of a blackish color, and about the thickness of a goose quill.

An investigation of the cerebral structure of the Ophidians shows that, in point of mental power, they occupy nearly the lowest place in the scale of being. Stupid and dull to the last degree, it is difficult to conceive how such a brute could have been adopted by all the old mythologies as a symbol of wisdom. The traditional serpent of the poets and mythologists is no-

where to be found among existing species, and, consequently, we may conclude never had a being except in fable. And yet this most stupid and disgusting of all creatures was, in many ancient systems, as the Egyptian and Scandinavian, an emblem of the conservative power of Nature. A Christian sect was called by its name (the Ophidians), and employed serpents in their religious ceremonies as a type of the Infinite Wisdom. Traces of snake worship may also be found in the Old Testament. With our instinctive antipathy to the serpent, and the experience of that crawling horror which its presence, and even the thought of it, inspires, we cannot conceive how any human beings could ever have regarded it with other feelings, and much less how they ever could have received it as a symbol of wisdom and goodness. On the contrary, we feel that the terrible hideousness of the forms of all, and the poisonous character of some, might well represent the Evil Principle of the universe.

ORDER IV. BATRACHIA (Frogs and Toads).

The Batrachians, according to Cuvier, have but one auricle and one ventricle to the heart, which, however, is disputed by Professor Owen. Their two lungs are always equal (we here follow Baron Cuvier), and when young, they conjoin to their gills, which give them a relationship with the class of fishes. The greater number lose these gills upon attaining the perfect state, the only exception being the Syrens, the Protei, and the Menobranchi, which retain them at all ages. During the period of the retention of the gills, the aorta, on proceeding from the heart, divides into a number of branches upon each side, corresponding to that of the gills, the blood from the gills returning through veins, which unite together towards the back into a single arterial trunk, as in fishes. This trunk supplies the greater number of the arteries which nourish the body, and even the vessels which conduct the blood for respiration into the lungs. But in the species which shed their gills, the vascular ramifications that communicate with them become obliterated, excepting two, which unite together to form a dorsal artery, each giving off a small branch to the lung of its particular side, so that the circulation of a fish becomes thus converted into that of a reptile.

The Batrachians have no scales, but are clothed with a naked, smooth, and moist skin, and, excepting one genus, have no nails to their toes. The eggs are laid in the water, and the young bear little or no resemblance to the form which they assume at maturity. Some of the species are viviparous.

GENUS RANA.—The Frogs. The Frogs are the most numerous, and

consequently the best known, group of the Batrachian family. They are distributed through all regions, and, we believe, there is no land where their singularly-varied voice is not heard, either as a harbinger of the opening spring, or a sure prophecy of approaching rain. They have a somewhat slender body, and four legs, the hinder ones very long, and the feet palmated. Their head is flat, the muzzle rounded, the mouth deeply cleft, and the greater number have a soft tongue attached only to the lower part of the gullet, but which extends forward to the jaw, and is doubled back above. Their fore feet have only four toes, but the hinder sometimes show the rudiment of a sixth. The males have, on each side, under the ear, a delicate membrane, which is inflated with air when they croak.

Their skeleton is entirely deprived of ribs. A cartilaginous plate, even with the head, takes the place of tympanum, and renders the ear visible externally. The eye has two fleshy lids, and a third, which is horizontal and transparent, concealed by the lower one.

The inspiration of air is produced simply by the movements of the muscles of the throat, which, by dilating, draw in the air through the nostrils, and, by contracting, whilst the orifices of the nostrils are closed by means of the tongue, force the air into the lungs. Expiration, on the contrary, is effected by the contraction of the muscles of the lower belly.

The eggs are fecundated at the moment they are laid, and the young is termed a *Tadpole*. It is at first provided with a long, fleshy tail, and a small, horny beak, but with no other apparent members besides certain little fringes at the sides of the neck. These disappear after some days, but Swammerdam assures us that they still exist as gills underneath the skin. The latter are minute crests, which are very numerous, attached to the four cartilaginous arches, placed on each side of the neck, adhering to the hyoid bone, and enveloped by a membranous tunie, which is covered by the general skin. The water, entering by the mouth, to bathe the intervals of these cartilaginous arches, passes out either by two orifices or by a single one, according to the species, piercel through the external skin, either on the middle or on the left side of the animal. The hind feet are gradually developed to view, by little and little, while the anterior likewise appear beneath the skin, but do not burst it for some time later. The tail is absorbed by degrees. The beak falls, and occasions the genuine mandibles to appear, which had previously been soft, and were concealed underneath the skin. The gills shrink, and are obliterated, leaving the lungs to perform their functions unassisted by them. The eye, which in the Tadpole was only visible through a thinner space in the skin, becomes apparent with its three lids. The intestines, previously very long, slender, and spirally contorted, shorten, and acquire the enlargement of stomach and colon. The Tadpole

lives solely upon aquatic vegetation, whilst the adult animal preys on insects and other animal substances. Finally, the limbs of the Tadpole reproduce the parts of them that had been mutilated, nearly as in the Newts.

"The particular epoch of these several changes varies according to the species.

"In temperate and cold climates, the perfect animal buries itself, during winter, under ground, or in the mud below the surface of water, where it continues to live without food or respiration, beyond what of the latter is effected by the surface of the skin."

The active powers of this animal are astonishingly great, when compared with its unwieldy shape; it is the best swimmer of all four-footed animals, and Nature has finely adapted it for those ends, the arms being light and pliant, the legs long, and endowed with great muscular strength.

The portion of brain which the Frog possesses is much less than might be supposed from its make; the swallow is wide, and the stomach narrow, though capable of being distended to an astonishing size; the heart, as in all other animals that are truly amphibious, has but one ventricle, so that the blood can circulate, whilst it is under water, without any assistance from the lungs; these resemble a number of small bladders, joined together like the cells of a honey-comb, and can be distended or exhausted at the creature's will.

A single female produces from six to eleven hundred eggs at a time; but this only happens once a year. The male is of a grayish brown color, but the skin of the female is of a yellow hue; these colors grow deeper with every change, which frequently happens every eighth day. The Frog generally lives out of the water; but, when the cold nights set in, it returns to its native place, always making choice of those stagnant waters, at the bottom of which it is most likely to remain concealed; there it remains torpid during the winter season; but it is roused into activity by the genial warmth of spring. The croaking of these animals has long been considered as the certain symptom of approaching rain; and no weather-glass can describe a change of season with more accuracy than this vociferous tribe; and we could hardly imagine that a creature of that size could send forth sounds that would extend the distance of three miles. All very dry and hot seasons are allowed to be injurious to the health of these animals; and, as they live chiefly upon snails and worms, at those periods they find it difficult to procure a sufficiency of food. "The method they adopt to ensnare these unsuspecting creatures affords entertainment to the curious mind. When they observe their destined prey approaching, for some moments they remain immovably fixed, and, when they are sufficiently near, spring suddenly upon them, at the same time darting their long tongue from their mouth,

which is covered with a glutinous substance, to which whatever it touches adheres."

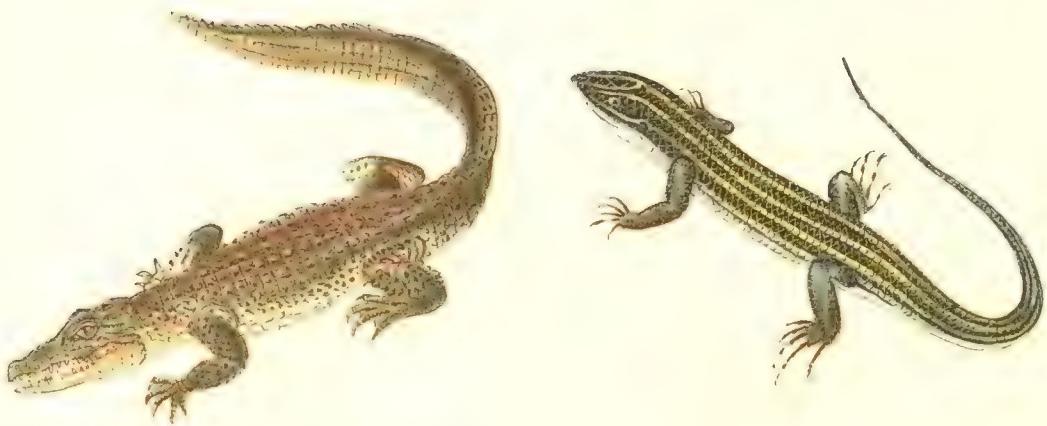
The Frog is not only capable of existing with a small portion of nourishment, but will live several hours after the head has been severed from the frame; and schoolboys frequently, in the wantonness of cruelty, strip the unfortunate creatures of their skin for the purpose of seeing how much vigor they are possessed of, though suffering the most excruciating torture and pain.

One species (*Ceratophorus*) has a very broad head, and a horn-like prominence over each eye. The *Dactylethra* is a South African species, with pointed toes. The Tree-frogs (*Hyla*) have their toes formed into "a sort of viscous palette," by means of which they climb trees, where they dwell during summer, feeding on insects. They seek the water, however, like the other frogs, for the purpose of depositing their eggs, and spend the winter in a state of torpor, buried in the mud.

GENUS BUFO.—The Toads. This group is composed of animals of a most hideous and disgusting form. Their thick, squat bodies, covered with tubercles, and a large swelling behind each eye, from the pores of which exudes a fetid, milky secretion, renders them peculiarly disagreeable to the sight. A singular species, the *Rana pipa*, of Linnaeus, is peculiar to South America. The body is horizontally flattened; head large and triangular; tongue wholly wanting; tympanum concealed beneath the skin; small eyes placed towards the margin of the upper jaw, and each of the front toes split, at the tip, into four little points. It inhabits the obscure nooks of houses in Cayenne and Surinam, and has a granulated back, with three longitudinal ranges of larger granules. The male places the eggs of the female upon her back, where they are fecundated, upon which the female returns to the water, the skin of her back swelling so as to form a number of cells, which enclose each of the eggs, and wherein the young pass their tadpole state until they have lost their tails, and developed their limbs, at which time the mother returns to land.

GENUS SALAMANDER.—The Salamanders. These animals were once believed to have the power to resist excessive heat, and dwell comfortably in the hottest fires. We need not say that no such creatures exist. The opinion probably arose from the circumstance that the Salamander expresses from the pores of its body a profuse liquid, which enables it, for a short time, to withstand the action of fire.

They have an elongated body, four limbs, and a long, thick tail. The head is flattened, and the jaws are armed with numerous small teeth. The tadpoles breathe at first by gills, in the form of crests, three on each side of the neck. The adults respire in the same manner as the frogs. The



AMERICAN BOX TURTLE



terrestrial Salamanders only remain in the water during the tadpole state, and when they return to that element to deposit their eggs. The aquatic species (the Tritons) live almost entirely in the water.

One of the most remarkable characteristics of these animals is the power which they possess of reproducing their limbs when they have been torn away. According to the experiments of Spallanzani, they renew, many times, successively, the same member after it has been severed; and this with all its bones, muscles, vessels, &c. Another faculty, not less singular, consists (as shown by Dufay) in their recovering after having been long frozen up in ice. The eggs are fecundated by fluid dispersed in the watery medium, which penetrates with the water into their oviducts. They lay long chaplets of eggs, and the young appear fifteen days from the deposition of them, retaining their gills for a longer or shorter period, according to the species. Modern observers have distinguished several species, the males of which develop high, membranous, dorsal crests very early in the spring, which are absorbed, and the remnants cast off, ere they leave the water, at the end of summer. One, with a smooth, olive-colored skin like a frog, and handsomely spotted with black, is common in stagnant waters; and two others, with a granulated skin like a toad, and also spotted upon a much darker ground, and punctuated with white, are (the first at least) equally so. All have the under parts bright-orange color. Those with granulated skins resemble the toads in the capability of remaining without food for a most extraordinary period, in a state of imprisonment, having been found occasionally in closed cavities, where they must have remained for many years.

Following the Salamanders, and somewhat allied to them, there are several animals, some of which retain the gills permanently, while others do not seem to possess them at all. The latter constitute the genus *Menopoma*. These reptiles are peculiar to North America, and are called by the people *Hell-benders*. They are about eighteen inches in length.

Among those which have the gills developed are the *Menobranchi*, the *Protei*, and the *Syrens*. The *Protei* have three toes before, and but two behind. The eyes are couched beneath the skin, thus adapting them to their manner of living in subterranean waters. The *Syrens* have a body shaped much like that of the eel. They have only two feet, which are placed a little below the throat. The head is flattened, and muzzle obtuse. They have three branchial crests. They are small animals, although one species, *Syren lacertina*, attains the length of three feet.

CLASS IV. PISCES. THE FISHES.

WE now come to the consideration of the most numerous class of vertebrate animals, which, in multitudinous variety, fills the ocean-world with life, and the inland lakes and rivers with the perpetual spectacle of a joyous existence. They inhabit all depths of the ocean (at least as far below the surface as animal life is possible), the different genera occupying different strata; and many of them are confined by geographical limits, although some, and those generally the most useful to man, range through all oceans, and appear to be at home in all seas. Many of them are interesting from their extreme beauty and gorgeous colors, and others from their great utility to mankind as articles of food. The most brilliant tribes inhabit the milder regions of the globe, and flash their splendors among the coral-groves of the tropical seas. All the colors of the rainbow are combined in the hues of their scaly vesture; and as they dart from branch to branch among the reefs of coral, through the clear and silvery water, each movement reveals new combinations of tints which no art can ever equal.

There are over eight thousand species of fishes recorded by naturalists, and probably there are thousands more in those distant seas which have never yet been visited by civilized man. The fecundity of this class is extraordinary. A single cod produces, each year, over nine millions of eggs, and a sturgeon more than seven, while most of the other species are proportionally prolific. And yet, preying upon each other as they do, and exposed to numerous enemies besides, among whom is man, who destroys countless millions annually, were it not for this remarkable increase, the sea would soon be without inhabitants.

The age of a fish may be ascertained by an examination of the scales, which consist of concentric circles, the number of circles corresponding to the number of years it has lived. Where scales are wanting, the age may be determined by the number of rings on the articulating surfaces of the back bone. The life of a fish is a constant struggle for existence, and the ocean is the scene of perpetual warfare; and, consequently, it is not probable that many live out the full term of existence. "But, if only few fishes die a natural death, a life of liberty makes them some amends for their violent end. The tortured cart-horse and ox would, if they could reflect, willingly exchange their hard lot and joyless existence for the free life of the independent fish, which, from the greater simplicity of its structure, its want of higher sensibilities, and the more equal temperature of the element in which it lives, remains unmolested by many of the diseases to which the warm-blooded, and particularly the domestic, animals are subject."

Fishes are described by Cuvier as viviparous vertebrata, with a double circulation, and respiring through the medium of water. For this purpose they have, on each side of the neck, branchiae, or gills, consisting of arches of bones attached to the *os hyoides*, or bone of the tongue; and to these arches the filaments of the gills are attached, generally in a row upon each, and having their surfaces covered by a tissue of innumerable blood-vessels. The water taken in by the mouth passes through among the filaments of the gills, and escapes by the gill-openings towards the rear. In its progress through the filaments of the gills, the water imparts to these the oxygen of the air which it contains, and receives carbon in return, the same as in the lungs of an air-breathing animal. The gills of a fish do not decompose water, so as to derive oxygen from it, but merely separate the oxygen from the atmospheric air contained in the water; and hence, if water is deprived of this air, or impregnated with deleterious gases, fishes cannot live in it.

As little can they bear the return of water entering at the gill-openings, and escaping by the mouth; for, if a fish is held so that the water is made to pass in this direction, it is as speedily drowned as if it were an air-breathing animal. The blood is brought to the gills by the heart, which thus answers to the right ventricle of warm-blooded animals; and from the gills it is sent to an arterial trunk, lying immediately upon the under side of the back bone, which trunk is the left, or systematic, ventricle of the heart, and sends the blood throughout the body of the fish.

Living habitually in water, which is of very nearly the same specific gravity as their bodies, fishes have no weight to bear, but merely to propel themselves through the water; and their form, and their organs of motion, are all adapted to this one purpose, though varying in the species. In many there is, under the spine, a membranous air-bladder, which the fish can contract or expand, at pleasure; and this is understood to alter its gravity, and enable it to suspend itself at any depth in the water. Many fishes, wanting this apparatus, have, however, nearly the same habits as others which are possessed of it.

Progressive motion is effected by the tail striking alternately right and left against the water, for which purpose the flexure of the spine is lateral, whereas, in the other vertebrata, generally, the principal flexure is vertical; and perhaps the jet of water thrown backwards from the gill-openings may assist. Thus a fish has but little use for extremities, and the parts analogous to legs and arms are accordingly very short, terminating in a number of rays analogous to fingers and toes; and these, covered by membranes, form what are termed *fins*. The fins, answering to arms, are called pectorals, and those, answering to legs, ventrals; and, besides these, there are often fins on the back called dorsal, behind the vent called anal, and on the extremity of the tail called caudal.

The texture of the fins is important in classification. If the rays consist of single bones, whether stiff or flexible, they are said to be spinous; and, if they consist of a number of jointed pieces, divided at their extremities, they are called soft or articulated.

The pectorals are attached to two bones immediately behind the gills, and answering to the scapulars, which bones are sometimes imbedded in the muscles, or attached to the spine, but generally to the bones of the head. The pelvis rarely adheres to the spine; and it is often in advance of the belly, and attached to the bones of the shoulders.

The vertebrae have their proximate surfaces concave, and filled with cartilage, which forms the joints, and is generally continued by an aperture through the centre of each vertebra. Spinous processes, upwards and downwards, support the muscles, and maintain the vertical position of the body; but, as far as the cavity extends, the downward processes are wanting, and there are transverse processes, to which the ribs are sometimes soldered by cartilages.

The head varies much in form, but, in general, consists of the same number of bones as in the other vertebrata—a frontal of six pieces, parietals of three, occipitals of five, and five of sphenoid, and two of each temporal bone included in the composition of the cranium.

Besides the brain, which is disposed as in reptiles, fishes have nodes, or ganglions, at the base of their olfactory nerves. The nostrils are simple cavities at the end of the muzzle, always pierced with two holes, and lined by a regularly-plaited pituitary membrane. In their eyes, the cornea is flat, and there is a little aqueous humor, but the crystalline lens is almost spherical, and very hard. The body is usually clothed with a scaly covering, although there are several species which have no visible scales.

Wonderful as it may appear to see creatures existing in a medium so dense that men, beasts, and birds must inevitably perish in it, yet experience proves that, besides those species, which we are in the daily habit of seeing, the very depths of the immense ocean contain myriads of animated beings, to whose very form we are almost strangers, and of whose dispositions and manners we are still more ignorant. It is probable, indeed, that the fathomless recesses of the deep contain many kinds of fish that are never seen by man. In their construction, modes of life, and general design, the watery tribes are, perhaps, still more astonishing than the inhabitants of either the land or the air. The structure of fish, and their adaptation to the element in which they are to live, are eminent proofs of divine wisdom. Most of them have the same external form (sharp at each end, and swelling in the middle), by which configuration they are enabled to traverse their native element with greater ease and swiftness. From their shape, men

originally took the idea of those vessels which are intended to sail with the greatest speed; but the progress of the swiftest sailing ship, with the advantage of a favorable wind, is far inferior to that of fishes. Ten or twelve miles an hour is no small degree of rapidity in the sailing of a ship; yet any of the larger species of fishes would soon overtake her, play round her, as if she did not move, and even advance considerably before her. The senses of fishes are remarkably imperfect; and, indeed, that of sight is almost the only one which, in general, they may be said to possess.

Since the time of Linnaeus, several attempts have been made to classify these numerous inhabitants of the watery element, and a number of systems has appeared, which are more or less entitled to respect. That of Professor Agassiz, founded on their scaly covering, is a very ingenious method, and extremely useful in determining fossil species, but is not so applicable to existing fishes as that of Baron Cuvier. We have chosen to follow the latter, therefore, in this work. He first separates them into two grand divisions,—the BONY FISHES and the CARTILAGINOUS FISHES,—the former of which he arranges in six orders, and the latter in two.

BONY FISHES. ORDER I. ACANTHOPTERYGII (Spiny-fins).

The larger number of known fishes are comprised in this order. "Their characters are spinous rays in the first dorsal fin, if there are more than one, and spinous rays in the first part, if there is one only; but sometimes, instead of a first dorsal, they have free spines, without any connecting membranes. The anal has also its first rays spinous; and there is, generally, one such ray in each ventral. By the first ray of a fin is meant the one nearest the head."

PERCIDE.—The Perch Family. This tribe is distributed over all parts of the globe, and is distinguished, as a general thing, by its brilliant tints, while some of the Perches are noted for their very gorgeous colors. Nearly all of them are delicate eating, and as much sought after as the trout, pickerel, or bass.

They have an oblong body, covered with rough or hard scales, with the gill-lid, or gill-flap, or often both, toothed or spinous in the margins. They are mostly thoracic, or have the ventral fins under the pectoral, and are subdivided according to the number of gill-rays. Those in the first division have seven rays in the gills, two dorsal fins, and the mouth is furnished with rows of extremely minute teeth.

GENUS PERCA.—In this group is the *P. fluviatilis*, or common Perch,

so well known in all the lakes and rivers of this country. Graceful and quick in its movements, darting here and there in pursuit of its food, often-times turning its sides of green and gold to the sun, and flashing its brilliant hues through the clear water, it offers a most interesting spectacle for observation. There is scarcely a boy in the land who is not familiar with Perch fishing; and even now we remember the enjoyment, when a youth, we experienced in this sport, and particularly with what pride we returned home from a successful expedition, bearing the trophies of our skill strung on a stick at our side.

Besides the genus *Percæ*, this division contains fourteen genera, among which is *Labrax*, the Bass (a marine fish), and *Apogon*, small fishes, of a red color, found in the Mediterranean. The King of Mullets, or Beardless Mullet, belongs to this group. Some Perches of this division have two dorsal fins, like the last, but long, pointed teeth. They are all small fishes peculiar to the warm regions of the east.

In the second division, they have also the same gill-rays, but only one dorsal fin; and the genera are arranged according to the characters of the teeth—*Merous*, the Great Perch, *Serranus*, the Sea-perch, and *Anthias*, the Barber (a beautiful red fish of the Mediterranean, with metallic reflection), are found here. There are several other genera inhabiting the waters of different parts of the world, most of them of extremely pleasing form and appearance.

All the preceding *Percideæ* have the ventrals placed immediately under the pectorals, but there are others which have them upon the throat. They comprehend several genera, the most remarkable of which are *Trochinius*, the Weevers, and *Uranoscopus*, the Star-gazers. The Weevers have the head compressed, the eyes near each other, the mouth obliquely upwards, the first dorsal fin short, but with a formidable spine on the first ray. These fishes are small, but their powerful armor of strong, sharp spines renders them nearly invulnerable to the attacks of their foes. They conceal themselves in the mud, and inflict severe wounds, with their dorsal spines, which are very painful, though it does not appear that the spines contain any poisonous matter, as the fishermen believe. They are of a silvery color.

The Star-gazers are so called, because the eyes are placed on the upper surface of the nearly-conical head, directed towards the heavens. They are cunning fishes, and catch their prey by concealing themselves in the mud, through which they protrude a narrow slip, with which the mouth is furnished behind the tongue, which attracts small fishes, and holds them fast.

The third division of the *Percideæ* comprises those which have the ventral fins behind the pectoral. To this series belong the genera *Sphyraena*, the

Sea-pikes, and *Mullus*, the Surmullets. The first of these are powerful and savage fishes, with oblong heads and projecting under jaws. One species, *S. Barracuda*, is as much dreaded, in warm seas, as the white shark. *Mullus* is a very celebrated genus, and was well known to the ancients. There are two species, the Striped Red Mullet and the Plain Red Mullet. They are beautiful fishes, and "the luxurious Romans used to feast their eyes on their changing colors, when dying, before they devoured their flesh."

THE HARD-CHEEKS. — The second family of *Acanthopterygii* is thus named on account of the singular appearance of the head, which is variously mailed or defended by spines and scaly plates of hard matter. There are several well-known genera.

GENUS TRIGLA. — The Gurnards. These fishes derive their name from the peculiar sounds which they utter on being taken out of the water. "They have the head vertical, armed on each side with hard and rough bones, two distinct dorsals, an air-bladder of two lobes, and extremely large pectorals, by means of which they are able to leap to a considerable height out of the sea. There are several species, among which the *T. cuculus* and *T. hirundo* are much esteemed for the table, although the latter is somewhat dry."

GENUS PRIONOTUS. — This is a fish peculiar to this country, resembling the former genus, but with pectorals so large that they can "support the body during a considerable leap through the air."

GENUS DACTYLOPTERUS. — The fishes of this group have the sub-pectoral rays numerous, longer than the body, and united by a membrane, by means of which they leap into the air to escape the pursuit of their enemies; but, as they cannot fly, they soon fall back again to become the victims of their relentless foes. They belong to the Mediterranean and Indian Oceans; they are small fishes, not more than a foot in length.

GENUS COTTUS. — The Bull-head. A depressed head, teeth in both jaws, the gill-lids furnished with spines, gills with six rays and large openings, bodies slender, and without visible scales, two dorsals, and small vertical fins are the distinguishing characters of this class. They frequent both the sea and rivers. The River Bull-head is said to evince the same parental affection for its ova as a bird for its nest, returning quickly to the spot where they are deposited, and being unwilling to quit it when disturbed.

GENUS APIDOPHORUS. — The Pogge. This is a singularly-formed fish, sometimes called the Armed Bull-head. The body is octangular, and covered with scaly plates, and its snout is furnished with recurved spines. It frequents our rivers, and all the shores of the Northern Atlantic and Pacific Oceans.

GENUS SCORPENA. — Some of the species are gregarious, having their

haunts among the rocks. With the exception of their armed and tuberculated heads, they resemble the perches. Their spines are considered poisonous. As a general thing, the fishes of the Hard-cheek family are all very disagreeable in appearance, and most of them entirely useless to man as food, and, with the exception of the following group, totally devoid of interest.

GENUS GASTEROSTEUS. — The Stickleback. This fish receives its name from the free spines on the back, and a bony covering on the belly. There are several species, chiefly distinguished by the number and character of their spines. They inhabit both salt and fresh water. The Stickleback is a small fish, but extremely voracious. It is, however, one of the few fishes which exhibit anything like an affection for their progeny. It possesses the parental instinct to a remarkable degree, and manifests much skill in the construction of the nest which it prepares for its spawn. After the fish has collected the materials, it covers them with sand, glues the walls with a mucous secretion, and prepares a suitable entrance. At a later period, it becomes the bold and indefatigable defender of its eggs, repelling, with tooth and prickles, all other Sticklebacks that approach the nest. If the enemy is too powerful, it has recourse to artifice—dares forth, seems actively engaged in the pursuit of an imaginary prey, and succeeds in diverting the aggressor's attention from its nest.

THE SCIOENIDÆ. — The third family of bony fishes is thus named. They also resemble the perches, but have no teeth on the palate. The muzzle is thickened, and there are a few scales on the dorsal fins. There are over twenty genera, many of them distinguished for their fine colors. Most of them are foreign, but quite a number are found in American seas, among which are *Otolithus*, with weak anal spines, no cirri, and some elongated or canine teeth; *Corvina*, with small, crowded teeth, and the second anal spine rather strong; *Johnius*, much esteemed as food, the flesh being white and easy of digestion; *Eqyes*, with a long and compressed body, elevated at the shoulders, and tapering to the tail; and *Haemulon*, with a lengthened muzzle, resembling that of a hog, and the lower jaw compressed, opening very wide, and of a bright red, on which account, in the West Indies, they are called "Red-throats."

The Mediterranean has a remarkable genus (the *Umbrina*), distinguished by a cirrus on the lower jaw. It is an extremely beautiful fish, of a golden ground color, with bright bands of steel blue. It sometimes attains the weight of forty pounds, and its flesh is highly esteemed.

THE SPARIDÆ. — Sea-bream tribe. The *Sparide* constitute the fourth family of bony fishes. In general appearance they resemble the *Scioenidæ*.

They have no teeth on the palate, and no scales on the fins. The first division of this family comprises five genera, which have the sides of the jaws set with round, flat teeth, of remarkable strength. Among them is the GENUS *CHRYSOPHRIS*, the Gilt-heads, one species of which, *C. auratus*, is a large and beautiful fish, with a golden eyebrow. They all have very strong teeth, capable of crushing the hardest shells. Most of the members of this family are foreign fishes, and nearly all are noted for their fine colors.

THE MENIDÆ.—The fifth family of the *Acanthopterygii* comprises only four genera. They differ from the last in the great extensibility of the upper jaws, which is advanced or withdrawn by means of long, intermaxillary pedistes. The genera *Mæna* and *Smaris* inhabit the Mediterranean. The first of these has a body like that of a herring—lead colored on the back, and silvery on the belly. The third genus, *Cæsio*, belongs to Indian Ocean, and the fourth, *Geres*, to the Atlantic. The latter has a projectile mouth, and is much esteemed for the fine quality of its flesh.

SQUAMIPENNES.—Scaly-finned. The sixth family of bony fishes are thus named because the soft, and often spinous, parts of their dorsal fins are so covered with scales as not to be easily distinguished from the rest of their bodies. These fishes abound in warm seas, and are celebrated for the beauty of their colors. They are found near rocky shores, and their flesh is very palatable and nutritious.

GENUS *CHLETODON*.—The generic name of these fishes is derived from the peculiar brush-like appearance of the teeth. They all resemble each other, even in their colors, being marked with a black band which passes over the eye. In some there are several vertical bands; others have them longitudinal or oblique; some have brown spots on the flanks; some have glossed bands on the vertical fins, and one or two ocellated spots. Some of them are also distinguished by filaments, produced from the soft rays of the dorsal, and others have very few spines in that fin.

GENUS *CHELMON*.—This fish is remarkable for the length of its snout, at the extremity of which is its mouth, which is furnished with fine teeth, like hairs. One species, *C. rostratus*, found near the shores of Southern Asia, has a most extraordinary method of hunting its prey. When it sees a fly alighting on any of the plants which overhang the shallow water, it approaches, with the utmost caution, coming as perpendicularly as possible under the object of its meditated attack. Then, placing itself in an oblique direction, with the mouth and ears near the surface, it remains a moment immovable, taking its aim like a firstrate rifleman. Having fixed its eyes directly on the insect, it darts at it a drop of water from the tubular snout,

but without showing its mouth above the surface, from which only the drop seems to rise, and that with such effect, that, though at the distance of four, five, or six feet, it very seldom fails to bring its prey into the water. Another small East Indian fish, the *Toxotes jaculator*, belonging to the same family, catches its food by a similar dexterous display of archery. There are ten other genera, mostly found in foreign seas.

Hemiochus (Coachman) have the first spines of the dorsal, and particularly the third and fourth, extended into filaments, like a whip, and often twice the length of the body.

Ephippus (Horseman), with a deep notch between the spinous and soft portions of the dorsal, the first of which has no scales, and can be folded into a groove on the back.

SCOMBERIDÆ.—The Mackerel tribe. The *Scomberideæ* compose the seventh family of bony fishes. They comprise, as Cuvier well remarks, a vast number of genera, numerous species, and countless individuals.

GENUS SCOMBER.—The Mackerel. This fish has a long, slender body, beautifully colored, and nearly smooth, the scales being very small. It quickly dies on leaving the water, exhibits, for a short time, a phosphorescent light, and loses, in a great measure, the brilliancy of its hues. It is not surpassed by any fish in its commercial value; for, either fresh or salted, it is a common article of food, at all seasons of the year, in the families of nearly all civilized nations. It is an extremely voracious animal, and makes great havoc among the herring-shoals, although its own length is only from twelve to sixteen inches. It ranges through all the seas of North America and Northern Europe, and is everywhere esteemed as one of the most valuable of our edible fishes. In winter, it retires into deep water, probably at no great distance from the shores, where it appears during the summer and autumn in such countless numbers.

The Mackerel is taken with seines, and with the hook and line; the latter method is by far the most interesting and exciting sport. It bites greedily at every bait, and often at the bare hook.

The vessels fitted out for this fishing are generally small schooners of from twenty-five to sixty tons burthen, the largest of them carrying a crew of from eight to ten men. When the fishing-ground is reached, the vessel is "hove to," and the deck prepared for action. The lines are furnished with two hooks each, and are fastened to "belaying-pins," inserted in the capping of the bulwarks. One man tends two lines, and has placed near him, on the right, a barrel to receive his prey. The gills of the Mackerel are very tender, and the fisherman is not obliged to disengage the fish from the hook with his fingers, as is the case with the cod and many other kinds of

fish, a slight jerk of the arm being sufficient for the purpose, and which lodges the Mackerel securely in the barrel with his brother-victims. When the biting is "lively," the work is more like sport than toil, as the excitement takes away from the fisherman all sense of fatigue, and he stands by his lines, drawing them in, one after another, with the greatest rapidity, and without intermission, hour after hour.

A bait of ground fish is thrown out to *tole* the school up to the vessel; but the Mackerel is a very capricious animal, sometimes rushing at the hooks, baited or unbaited, with perfect madness, for hours, and at others refusing to bite for days together. We have been among schools of Mackerel for two or three days, when their incalculable numbers actually darkened the water, and yet not a single individual would be tempted to touch the hook.

The business of Mackerel-catching in this country commences in the spring, off' the coasts of Florida. As the summer advances, the shoals migrate to the north, and later in the season the whole coast is alive with them from Newfoundland to the capes of Delaware, when the waters of the Atlantic, along the American shores, studded with countless numbers of fishing-vessels, present a very animated spectacle.

This fishing appears to be prosecuted with equal zeal on the other side of the ocean, especially on the coasts of Great Britain. In an interesting work, entitled *Wild Sports of the West*, we find the following lively picture of Mackerel-catching off' the Irish shores:—

"It was evident that the bay was full of Mackerel. In every direction, and as far as the eye could range, gulls and puffins were collected, and, to judge by their activity and clamor, there appeared ample employment for them among the fry beneath. We immediately bore away for the place where these birds were numerously congregated, and the lines were scarcely overboard, when we found ourselves in the centre of a shoal of Mackerel. For two hours we killed these beautiful fish, as fast as the baits could be renewed and the lines hauled in; and when we left off fishing, actually wearied with sport, we found that we had taken above five hundred, including a number of the coarser species, called Horse-mackerel. There is not, on sea or river, always excepting angling for salmon, any sport comparable to this delightful amusement: full of life and bustle, everything about it is animated and exhilarating; a brisk breeze and fair sky, the boat in quick and constant motion, all is calculated to interest and excite. He who has experienced the glorious sensations of sailing on the Western Ocean, a bright autumnal sky above, a deep-green, lucid swell around, a steady breeze, and as much of it as the hooker can stand up to, will estimate the exquisite enjoyment our morning's Mackerel-fishing afforded."

Nearly all of the *Scomberidae* family visit the shores in summer for the

purpose of "depositing their spawn, and they subsist, in great part, upon the fry of the later spawners, as those again live upon theirs, which is a beautiful adaptation, whereby the immense surplus of one family of fish adequately supplies the wants of another."

The genus *Scomber* is separated into several sub-genera. They are the *Gempylus*, whose ventral fins are scarcely perceptible; the *Cybium*, found in the warm parts of both oceans, some species of very large size; the *Soula*, common in the Black Sea and Mediterranean; the *Auxis*, found on the Mediterranean, of a fine blue on the back, with oblique blackish lines, and the flesh deep red. A West Indian species attains an extremely large size; *Orcynus*, with long pectoral fins, blackish back, and silvery belly, visits, during the summer, the Bay of Biscay and the Mediterranean in numerous shoals. But the following sub-genus is the chief of the tribe.

THYNNUS. — The Tunny. This celebrated fish has a soft corselet of large scales on the thorax, a cartilaginous keel between the crests and the sides of the tail, and the first dorsal approaching the second. It abounds in the Mediterranean, where it is often found from fifteen to eighteen feet in length. It is captured in vast numbers, and constitutes an essential article of food. The flesh is as solid as that of the sturgeon, but is much more finely flavored. Pennant affirms that he saw one killed in 1769 which weighed four hundred and sixty pounds.

Tunny-catching, according to Mr. Yarrell, is a very important business in the Mediterranean. He says, "In May and June, the adult fish rove along the coast in large shoals and triangular array. They are extremely timid, and easily induced to take a new, and apparently an open, course, in order to avoid any suspected danger. But the fishermen take advantage of this peculiarity for their destruction by placing a lookout or sentinel on some elevated spot, who makes the signal that the shoal of Tunnies is approaching, and points out the direction in which it will come. Immediately a great number of boats set off, range themselves in a curved line, and, joining their nets, form an enclosure, which alarms the fish, while the fishermen, drawing closer and closer, and adding fresh nets, still continue driving the Tunnies towards the shore, where they are ultimately killed with poles.

But the grandest mode of catching the Tunny is by means of the French *madrague*, or, as the Italians call it, *tonnaro*. Series of long and deep nets, fixed vertically by corks at their upper edges, and with lead and stones at the bottom, are kept in a particular position by anchors, so as to form an enclosure parallel to the coast, sometimes extending an Italian mile in length; this is divided into several chambers by nets placed across, leaving narrow openings on the land side. The Tunnies pass between the coast and the *tonnaro*; when arrived at the end, they are stopped by one of the cross-

nets, which closes the passage against them, and obliges them to enter the *tonnaro* through the opening which is left for them. When once in, they are driven, by various means, from chamber to chamber to the last, which is called the 'chamber of death.' Here a strong net, placed horizontally, that can be raised at pleasure, brings the Tunnies to the surface, and the work of destruction commences. The *tonnaro* fishery used to be one of the great amusements of rich Sicilians, and, at the same time, one of the most considerable sources of their wealth. When Louis XIII. visited Marseilles, he was invited to a Tunny-fishery, at the principal *madrague* of Morgiou, and found the diversion so much to his taste, that he often said it was the pleasantest day he had spent in his whole progress through the south."

There are several species of Tunny, of which the bonito is the most striking. It forms the principal food of the sword-fish.

XIPIAS.—This genus comprises the Sword-fishes, which, in their internal organization, minute scales, and the power of their caudal fin, resemble the tunnies. Their principal characteristic, however, is a long, pointed beak, formed like a sword or spit, which terminates their upper jaw, and is a most formidable weapon. The gills are not divided, "but each consists of two large and parallel laminae, with reticulated surfaces." Their movements are extremely swift, when pursuing their prey, but often their motions are very slow and deliberate, and we have frequently seen them, for a considerable period, apparently at rest, showing the apex of the dorsal fin above the surface.

Xiphias gladius, the species common in our waters, attains a length of about fifteen feet. As the remarkable beak, or sword, that distinguishes this fish, is not required or employed in procuring its food, which consists chiefly of small fishes, especially the bonito, it must probably be regarded as a weapon of defence against the attacks of powerful enemies. The stories regarding the warfare made by the sword-fish upon the whale are, undoubtedly, "fables of the sea," which have come to be believed from their long repetition. Experienced and intelligent whalers repudiate all these tales as impossibilities. Yet it is true that, when in eager pursuit of its prey,—the bonito,—it sometimes unintentionally, and unfortunately for itself, rushes against a whale, and loses its sword in the whale's blubber, which does not materially injure the latter, while the sword-fish is irreparably damaged thereby. In the same way, while similarly engaged, it has been known frequently to run against the sides of a ship, and thrust its sword through its thick and strong timbers. We have seen such timbers, with the broken weapon still adhering. But these must be considered accidental and unintentional encounters.

There are several varieties of this fish; one, *Tetrapturus*, has a beak

shaped like a stiletto, and another, *Istiophorus*, has a beak like the preceding, but the dorsal fin high, serving as a sail in swimming. All of the group are of large size, and the flesh, especially that of *Xiphias gladius*, is much esteemed.

CENTRNOTUS.—This genus is distinguished by having free spines instead of the first part of the dorsal; all the species are furnished with ventral fins. The best known representative of the class is,—

Nauclerates ductor, the Pilot-fish, which has a spindle-shaped body, free dorsal spines, and two free spines before the anal. The South American black species attains the enormous length of eight or nine feet. The Mediterranean Pilot-fish does not exceed a foot in length, but is an extremely swift and voracious animal, following in the wake of ships, accompanied by sharks, which it was formerly supposed (erroneously) to lead, whence its name. The following sub-genera are,—

Echelatus, form and dorsal spines like the last, but the head flattened, and the keel and anal spines wanting.

Lichia, has dorsal and anal spines on the back, one of the former lying flat and direct forwards, but the body is compressed, and no keels on the tail. There are several species in the Mediterranean, all edible, and some of large size. *Trachinotus*, merely has the body a little more elevated, and the dorsal and anal longer and more pointed.

RHYNCHOBDELLA.—In their spinal structures the fishes of this group resemble the former genus, but have no ventrals. The sub-genera are,—

Micrognathus, with a pointed, cartilaginous muzzle, projecting beyond the lower jaw, and the dorsal and anal separate from the caudal. *Mesotrembelus*, jaws equal, and dorsal and anal joined to the caudal. Both inhabit the fresh waters of Asia, and feed on worms, in search of which they plough up the sand with their cartilaginous noses; their flesh is much esteemed.

NOTACANTHUS.—The waters of the Arctic Ocean are the home of this genus, where individuals are sometimes found two feet and a half long. They have a pointed, cartilaginous muzzle, abdominal ventrals, and a long anal reaching to the top of the tail.

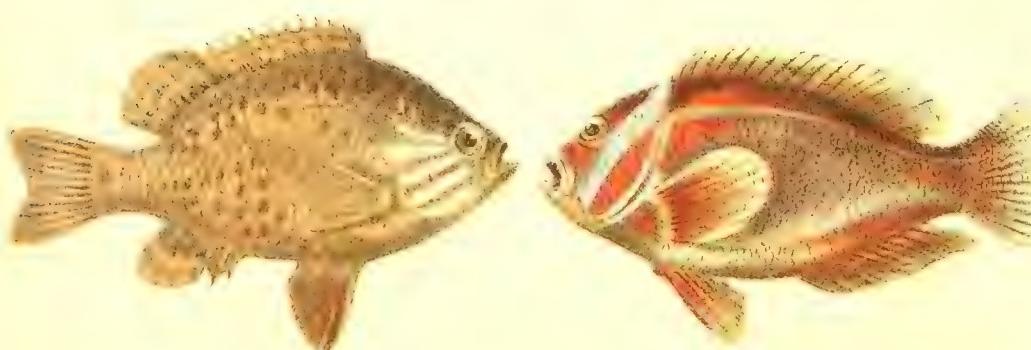
SERIOLA.—This genus resembles lichia, has a horizontal spine before the dorsal, but the dorsal spines united by a fin, a small fin with two spines before the anal, and no keel on the lateral line. One species is the Milk-fish of Pondicherry, so much esteemed for the delicacy of its flesh. There are several other species in both oceans.

NOMEUS, resemble the last, but have large ventrals attached to the abdomen by their inner edge; color, silvery, with transverse black bands on the upper part. Has been confounded with the gobies.



PERCH

MACKEREL



POND FISH OR RED GUDGEON

AMPHIPIRION FRENATUS



CAT FISH

TAUTOG



TROUT

TAUTOG

TEMNODON (Blue-fish). Tail unarmed, spines or small fins before the anal, first dorsal small, second and anal small, scales, one row of trenchant teeth in each jaw, with small, crowded ones behind, and on the vomer, the parietals, and tongue; seven rays on the gills, and the gill-lid forked. There are species common to both oceans, and about the size of the common mackerel.

CARANX, have the lateral line, with scaly plates, keeled, and often spinous, horizontal spine before the first of the two dorsals, last rays of the second dorsal often detached, some spines or a small fin before the anal. These fishes do not appear to have any geographical limits, but are found in all seas. They resemble mackerel, and are called Bastard or Horse-mackerel, and they sometimes make their appearance in immense shoals, literally "banking the sea." They feed on the fry of herrings, and are not in much estimation as food.

"VOMER.—This genus have the body more and more compressed and elevated in the different sub-genera, while the armature on the lateral line diminishes, and the skin becomes smooth, like satin, without any apparent scales. They have no teeth, except short and fine ones crowded together; and the sub-genera are chiefly distinguished from each other by various filamentary prolongations of some of the fins. The following are the sub-genera:—

"*Olistus*.—These resemble *Situlae*, a sub-genus of Caranx, but the middle rays of the second dorsal are not branched, but merely articulated, and extend in long filaments.

"*Seyris*.—Nearly the same in form and filaments, but the spines of the first dorsal hidden in the edge of the second, and the ventrals short.

"*Blepharis*, has long filaments to the second dorsal and anal, the ventrals very long, and the spine scarcely above the skin; their body is very elevated, but their profile not so vertical as that of some of the other sub-genera found in the warm seas; and, in the West Indies, one species is called the "Cobbler." *Gallus*, similar to the last in all respects except having the profile more vertical. *Argyreiosus*, has the profile still more vertical, the first dorsal definitely formed, and some of its rays extended in filaments, as well as those of the second dorsal; the ventrals are also very long."

ZEUS, the Dory, has the first dorsal deeply notched between the spines, and the intermediate membranes extend into long filaments, together with the forked spines along the basis of the dorsals and the anal. One species, the Common Dory (John Dory), is yellowish-brown, with golden or silvery reflections, according to the position of the light, with a round black spot margined with white on the shoulders. "The Dory has been a renowned fish since the days of the ancients, who styled it not the fish of Jove, but *Zeus*,

that is, Jove himself. The monks also claimed it as the 'Tribute-money-fish,' from the black marks of the thumb and fingers of St. Peter on the shoulders, in which it is the rival of the haddock, neither of which fishes Peter had any chance of seeing. It is still held in great estimation by epicures; and, being a ground fish, it keeps two or three days, and is all the better for it."

Following the *Zeus*, and resembling it in many of its characters, are the genera *Cuprus*, the Boar-fish; *Lampris*, a large fish of the Arctic seas, of a violet color, spotted with white, and having red fins; *Equula* are small fishes of the Indian Ocean; some of the species have a projectile snout, with which they surprise their prey. Nearly motionless, the deceitful snout contracted and concealed, they wait till the small fry, on which they feed, are within reach, when they suddenly project the treacherous muzzle, and sweep the victims into their hungry jaws; *Menas* is also an inhabitant of the Oriental seas, of a silvery color, with a black spot near the back; *Stromateus* resembles the foregoing, with the exception that its muzzle is blunt and non-protractile; *Peprius* "has the pelvis trenchant and pointed before the vent;" *Luvanus*, some species of which are of large size, of a silvery color, with a red back; *Seserinus* is a small Mediterranean fish, and *Kurtus* is found in the Indian seas.

CORYPHENA (Dorades, or Gold-fishes), the Dolphins of the ancients and of the modern Hollanders. They have the body long, compressed, and covered with small scales; the head trenchant in the upper part; a single dorsal, which extends the whole length of the back, with flexible rays the whole length, but the anterior ones not jointed, and they have seven rays in the gills. The following are the sub-genera: —

Coryphaena, the Coryphene, properly so called, have the head much elevated, the profile curved and descending rapidly; they have teeth in the palate, as well as in the jaws. They are large and splendidly-colored fishes, celebrated for the velocity of their motions, and the havoc which they commit among the flying-fishes. "*C. hipparis*, the common Coryphene, is found in the Mediterranean and Atlantic. It is a brilliant fish, and drives through the water like a radiant meteor. Its long dorsal is sky blue, with the rays gold colored; its tail-fin green; its back green, mottled with orange, and its belly silvery, divided from the former by a yellow lateral line. As it passes along, however, there is an extraordinary play of colors upon it; and it is one of the fishes, with the changes of whose colors, when dying, the luxurious Romans used to gloat their depraved fancy. Some of the Indian species are brighter colored than this one; and, indeed, all the Scomberidae have a tendency to get blackish in the cold seas, and brilliant in the warm ones, owing to the greater effect of the solar light in

the latter, for the sunbeam is Nature's pencil, down even to the deepest fish or pearl shell."

Curanaxamores. — These fishes differ from the above in having the head oblong and less elevated. The other sub-genera are the *Centrolophes*, *Pteraclis*, and *Astrodermus*. The last is found only in the Mediterranean. It has a very long dorsal. The body is silvery, spotted with black, and the fins are red.

TENIDÆ (Ribbon-shaped Fishes). — These singular-looking creatures compose the *Eighth Family of the Acanthropterygii*. They have long bodies, flattened on the sides, and very small scales. They are separated into three tribes; those comprised in the first have an elongated muzzle, the mouth deeply cleft, and armed with strong, trenchant teeth, and the lower jaw projecting beyond the upper. There are two genera.

LEPIDOPUS. — The Scabbard-fish. It derives its name from the peculiar form of the ventrals, "which are merely two scaly plates. The body is thin and long. One species, *L. argyreus*, is sometimes found four or five feet in length. It often swims with the head out of the water, and is extremely rapid in its motions."

TRICHIURUS (Hair-tail). — These fishes have many characters like the last, but "have no ventral, anal, or caudal fins, excepting a few little spines on the under side of the tail, which terminates in a hair-like point." When seen laterally in the beams of the sun, they appear like "beautiful silver ribbons." There are several species in the Indian Ocean. One, *T. Lepturus*, is found in the Atlantic. It is of a shining, silvery color, with grayish-yellow fins, the dorsal mottled with black on the edge, and the irides are golden.

The second tribe is composed of such of the *Tenidæ* as have the mouth small and little cleft.

GYMNETRUS. — The fishes comprehended in this genus have a long and flat body, with a long dorsal, but no anal fin. They are remarkably tender, their bones soft, their fins extremely frail, and their flesh rapidly decomposes. They inhabit the Atlantic, Arctic, and Indian oceans, and the Mediterranean, and are sometimes found ten feet long.

STYLEPHORUS. — This genus has a caudal fin like the last, though not so long; "and instead of the tail ending in a hook in the middle of the fin, as it does there, it is produced in a filament longer than the body."

The third tribe consists of three genera, which have the muzzle short, and cleft obliquely.

SEPOLA. — This genus has a long dorsal and anal fin, and the top of the cranium flattened. The Red Snake-fish belongs to this group.

LOPHOTES.—These fishes belong to the Mediterranean. They have a short head, with an osseous crest, surmounted by a spine.

THEUTYES.—The Lance-fishes. These form the *Ninth Family of the Spiny-fins*. They have a compressed, oblong body, small mouth, and a single row of trenchant teeth in the jaws; but their distinguishing characters are the short, lance-like spines on the sides of the tail, and a horizontal one before the dorsal. Their spines are extremely powerful, and are used very efficaciously as weapons of defence. Their food is *fuci*, and other marine plants. The family is small; we know of but six genera, most of them inhabiting the Oriental seas.

PHARYNGINÆ LABYRINTHIFORME. *The Tenth Family of Spiny-fins.*

By the term *Pharynginae labyrinthiformæ*, is meant, that the upper membranes of the pharynx are divided into small, irregular leaves, more or less numerous in the different genera, containing cells between them, which the fish can, at pleasure, fill with water, and, by ejecting a portion of this water, moisten its gills, and thus continue its circulation while out of its proper element. From this contrivance of Nature herself, we are to understand that, if the gills of a fish can be kept properly moistened, by salt water or by fresh, according as the fish is naturally an inhabitant of one or the other, it may be carried alive over land to an indefinite distance. By means of this apparatus, these fishes are enabled to quit the pool or rivulet, which constitutes their usual element, and move to a considerable distance over land. This singular faculty was unknown to the ancients; and the people in India still believe that these fishes fall from heaven.

In cold and temperate climates this apparatus is not necessary, because all the ponds and streams there, which are capable of supporting fish, are perennial, and never dried up, except in seasons of extreme drought, when, of course, all the fishes perish. But in tropical countries, where the seasons are alternate drought and rain, there is neither food nor water for a fish during the one season, and plenty of both during the other. Hence these fishes are furnished with this peculiar apparatus in the pharynx, by means of which they are enabled to follow the water over dry obstacles, and, in some of the species, to climb steep banks, or even trees, in the course of their instinctive journeys. The following are the genera:—

ANABAS.—The Climbing Perch of India. This genus has the labyrinths highly complicated; the third pharyngi have pavement teeth, and there are others behind the cranium; the body is round in the section, and covered with strong scales; the head is large, the muzzle short and blunt, and the mouth small; their lateral line is interrupted for the posterior third; the margins of the operculum, super-operculum, and inter-operculum are strong-

ly toothed, but there are no teeth in the pre-operculum; their gills have five rays; they have many spinous rays in the dorsal and anal, and their stomach is of middle size, rounded, and with three coecular appendages to the pyrolus. Only one species is known, which not only quits the water, and moves over banks, but is said by Daldorf to climb bushes and trees by means of its dorsals and the spines on the gill-lids; but others dispute the latter power. This species is very common in India.

POLYACANTHUS has the spinous rays as numerous as the last genus, or even more so, and the same mouth, scales, and interrupted lateral lines, but the gill-lid is not toothed; the body is compressed; there are four rays in the gills, a narrow band of small, crowded teeth in the jaws, but no palatal teeth; the labyrinths are less complicated, and the pyrolus has only two coecular appendages.

MACROPODUS differs from the last in having the dorsal less extended, and that in the caudal and ventral ending in slender points; the anal is also larger than the dorsal.

HESOSTOMA have a small, compressed mouth, so protractile as to advance from and retreat to the sub-orbitals; they have small teeth on the lips, and some on the jaws of the palate; five gill-rays, on the arches of which, towards the mouth, there are lamellae resembling the external ones; the stomach is small, and has only two pyrolic coeca, but their intestine is long; the air-bladder is very stout.

OSPHIROMANUS is so called from a conjecture, apparently erroneous, that the labyrinths of the pharynx are organs of smell, resembles Polyacanthus, but has the forehead concave, the anal longer than the dorsal, the sub-orbitals and inferior edge of the pre-operculum finely toothed, the first soft ray of the ventrals very long, six gill-rays, the body much compressed. One species, *O. alfax*, grows as large as a turbot, and is considered more delicious. It has been introduced into ponds in the Isle of France and Cayenne, where it thrives well. The female, as in many other species of fish, digs a cavity in the sand for the reception of her eggs.

TRICHOPODUS has the forehead more convex than the last, a shorter dorsal, and only four gill-rays. The only known species is a small fish from the Oriental Isles, of a brownish color, with a dark spot on the side.

SPIROBRANCHUS resembles the Anabas, but has no teeth on the gill-lids, but teeth in the palate. The only known species is a minute fish of Southern Africa.

OPHICEPHALUS, like the rest of the family in most of its characters, especially in the pharyngeal labyrinth, and can creep for some distance over land; but it differs from all other Acanthopterygii in having no spines in the fins, except a short one on the first of the ventrals; the body is long

and cylindrical; the head flat, and covered with polygonal plates; the dorsal extends nearly the whole length; the anal is also long, and the caudal round it; they have five gill-rays; the stomach is obtuse, with moderately long coeca, and the abdominal cavity extends nearly to the base of the caudal. They are found in India and China, of various species, and different sizes. In the former country, the jugglers, and even the children, amuse themselves by making it crawl along upon dry ground; and, in China, the larger ones are cut up alive for sale in the markets.

"All the genera and species of this family are fresh-water fishes; and they have not hitherto been found, except in the south-east of Asia and the adjacent islands, and in Southern Africa."

MUGILIDÆ.—The Mullets. This tribe composes the *Eleventh Family of the Order Acanthopterygii*.

There are three genera—*Mugil*, *Tetragonurus*, and *Atherina*. The last occupies a place between the Mullets and Gobies. It has two dorsals far apart, and ventrals behind the pectorals. It is a small fish, but the flesh is delicate. There are numerous species. *Tetragonurus* comprises but one species, which inhabits the Mediterranean. It is of a black color, about a foot long, and its flesh is poisonous.

Mugil, the Mullet, properly so called, must not, however, be confounded with the Red Mullets, either plain or striped, which are included in the Perch family. Their organization has so many peculiarities that they might be formed into a separate family. Their body is nearly cylindrical, covered with large scales, two separate dorsals, with only four spinous rays in the first, and the ventrals are a little in rear of the pectorals. Their head is a little depressed, covered with large, angular, scaly plates; their muzzle is short; their form is an angle, in consequence of a prominence at the middle of the lower jaw; and their teeth are very small, and, in some, almost imperceptible. They have six gill-rays; the bones of the pharynx give an angular form to the gullet; their stomach terminates in a fleshy gizzard, resembling that of a bird; they have few coecal appendages, but the intestinal canal is long and doubled. They are gregarious, resorting to the mouths of rivers in large troops, and constantly leaping up out of the water. They feed, in part, upon small crabs and other crustacea, which they swallow entire. There are several species found in the European seas, of which the flesh is much esteemed. *M. labio* is an American fish. It is a small species, but has proportionally larger lips than the European Mullets.

GOBIODÆ.—The Gobies. *Twelfth Family of the Order Acanthopterygii*.

Thinness and flexibility of the dorsal spines are the peculiar characteristics of this family. The genera are quite numerous.

BLENNIUS. — "The Blennies have one well-marked characteristic in their ventral fins, inserted before the pectorals, and having only two rays each. They live in small troops, among rocks near the coast, swimming and leaping, and can exist for some time without water. Their skin is covered with a mucous secretion, whence they have their common name, Blennies. Many of them are viviparous, bringing forth their young alive, fully formed, and capable of subsisting by themselves."

There are several species—all small fishes, and of no value to man. The *B. phalis* is said to be remarkably tenacious of life, being capable of living many days if kept in moist grass or moss.

From this genus, the following sub-genera have been separated:—

Myxodes, with a lengthened head and pointed muzzle; *Salarias*, an inhabitant of the Indian Ocean; *Clinus*, with short-pointed teeth in several rows; *Cirrhobarba* has a little filament over the eye, one in the nostril, three longer ones at the end of the muzzle, and eight under the point of the lower jaw. It is found in Oriental seas; *Muraenoides*, the Spotted Gunnel, has the ventral smaller than in the others, and the body lengthened like a sword-blade. It is eaten by the Greenlanders; *Opistognathus* has the short snout of the true Blennies, rasp-like teeth, and three rays in the ventrals, which are directly under the pectorals. It belongs to the Indian Ocean; *Zoareus* comes nearer to the true Blennies, though it has but one spinal ray; *Z. labrosus* is an American fish, of an olive color, with brown spots, and specimens are sometimes found three feet in length; *Anarrhicas*, the last of this series, is an extraordinary fish. "The whole body is soft and slimy; the parietal bones, vomer, and mandibles are hard, with stout, bony tubercles, surmounted by small, enamelled teeth; but the front teeth are much larger and conical. This structure of the teeth gives them an armature which, added to their large size, makes them both fierce and dangerous fishes."

One species, *A. lupus*, the Sea-wolf, inhabits the northern seas, and is often met with. It is six or seven feet long, of a brown color. Its flesh is like that of the eel, and is salted by the Icelanders for food.

The *Anarrhicas lupus* has six rows of grinders in each jaw, excellently adapted for bruising the crabs, lobsters, scallops, and large whelks, which this voracious animal grinds to pieces, and swallows along with the shells. When caught, it fastens, with indiscriminate rage, upon anything within its reach, fighting desperately, even when out of its own element, and inflicting severe wounds if not cautiously avoided. Schönfeld relates that it will seize on an anchor, and leave the marks of its teeth behind, and Steller

informs us that one, which he saw taken on the coast of Kamtschatka, frantically seized a cutlass, with which they attempted to kill it, and broke it in pieces, as if it had been made of glass. No wonder that the fishermen, dreading its bite, endeavor as soon as possible to render it harmless by heavy blows upon the head. The great size of the monster, which in the northern waters attains the length of six or seven feet, and in the colder and more extreme northern seas is said to become still larger, renders it one of the most formidable denizens of the ocean. It commonly frequents the deep parts of the sea, but approaches the coasts in spring to deposit its spawn among the marine plants. Fortunately for its more active neighbors, it swims but slowly, and glides along with the serpentine motion of the eel.

"*GOBIUS*, the Gobies, or Sea Gudgeons, are easily recognized by the union of their ventrals, which are thoracic, and united, either for their whole length or at their basis, into a single hollow disk, more or less funnel-shaped. The rays of the dorsal are flexible, their gills have five rays only, and, like the blennies, they have but little gill-opening; they can live for some time out of water. Like the blennies, also, their stomach has no *cul-de-sac*, and their intestines no cæca. In their reproduction, they further resemble the blennies; and some species, as in these, are known to be viviparous. They are small or middle-sized fishes, which live among rocks near the shore, and most of them have a simple air-bladder."

They admit of division into the following sub-genera:—

Gobius, comprehending the Gobies, properly so called. They have the ventrals united for the whole of their length, and also a transverse membrane joining their basis in front, so as to form the whole apparatus into a concave disk. The body is lengthened, the head moderate and rounded, the cheeks turgid, and the eyes near each other, and they have two dorsal fins, the last of which is very long. Several species inhabit the European seas, the characteristics of which are not sufficiently ascertained. They prefer a clayey bottom, in which they excavate canals, and pass the winter in them. In spring, they prepare a nest in some spot abounding with sea-weed, which they afterwards cover with the roots of *zostera* (grass-wrack). Here the male remains shut up, and awaits the females, which successively arrive to deposit their eggs; and these he fecundates, and exhibits much solicitude and courage in defending them from enemies. The Goby is the Phycis of the ancients; according to Aristotle, "the only fish that constructs a nest."

Gobius Niger.—The Black Goby is a small species, five or six inches long, and is of no value, except as bait for other fish. It is one of the few fishes that evince affection for their progeny. It prepares a nest for its eggs. This fish inhabits the slimy bottoms of the lagoons near Venice, and burrows

galleries in the clayey soil, where it spends the greater part of the year, protected against storms and enemies. In spring, it digs more superficial dwellings among the roots of the sea-grass, to which the spawn attaches itself. The architect watches over the entrance of the house, opposing sharp rows of teeth to every intruder.

The sub-genus *Goboides* differs from *Gobius* only in having but one dorsal fin; *Tenoides* has a more lengthened body, eyes very small and almost hidden, and cirri on the lower jaw; *Eleotris* has flexible spines in the first dorsal, ventral fins separate, and six gill-rays. The fishes of this group live in the mud, at the bottom of streams, in the warm countries; *Callionymus* has, instead of gill-openings, a single hole on each side of the nape, the ventrals are longer than the pectorals, and are placed under the throat, the head is oblong, and the eyes are directed upwards. These fishes are adorned with fine colors; *Trichonotus* has wide gill-openings, a lengthened body, and a single dorsal, the first ten rays of which are extended in long threads; *Comephorus* has an oblong muzzle, gills with seven rays, very long pectorals, but no ventrals. This fish inhabits the Lake of Baikal, and is valued on account of its oil; *Chirus* has a somewhat long body, with small, ciliated scales, and a dorsal fin extending along the entire back. This fish is found only in the Sea of Kamtschatka; *Periophthalmus* has the head scaly, eyes with a movable underlid, and the pectorals scaly for more than half their length, which gives the appearance of having wrists. As the gill-openings of these fishes are much smaller than those of the Gobies, they can live for a longer period out of water. Fleeing from their enemies, or pursuing their prey, they are often seen creeping or leaping along the muddy marshes of the Molucca Islands, which they inhabit.

PECTORALES PEDUNCULATI. Thirteenth Family of the Order Acanthopterygii.

The name given to this singular family signifies *Fishes with wrists to their pectoral fins.*

"There are some spinous fishes in which the carpal bones are so elongated as to form a sort of arm or wrist, to the extremity of which the pectoral fin is articulated. The family consists of genera closely allied to each other, though authors have sometimes placed them far apart in their arrangements; and they are also related to the Gobies, particularly to *Periophthalmus*, already noticed. This is a very peculiar structure of the fins, and gives these fishes a strange appearance, enabling them, in some instances, to leap suddenly up in the water, and seize prey which they observe above them; and in others to leap over the mud, somewhat after the manner of frogs.

"LOPHIUS. — Anglers. The distinguishing characteristic of these, besides

their demi-cartilaginous skeleton, and their skin without scales, consists in the pectoral being supported as by two arms, each consisting of two bones, which may be compared to the radius and ulna of an arm, but which, in reality, belong to the carpus, or wrist; and, in this genus, they are larger than in any other. They are also characterized by having the ventrals placed much in advance of the pectorals, and by having the operculum and the gill-rays enveloped in the skin, so that the gill-opening is merely a hole situated behind the pectoral. They are voracious fishes, with a large stomach and a short intestine; they can live a long time out of the water, in consequence of the small size of their gill-openings. They admit of division into three sub-genera.

"*Lophius*. — These fishes have the head excessively large compared to the body, very broad, depressed, and spinous in many parts; the mouth deeply cleft, and armed with pointed teeth, and the lower jaw fringed round with many fleshy barbules. They have two dorsal fins, and some rays of the first are free, and move on the bones of the head, where they rest on a horizontal, inter-spinal process. In the Angler, or Fishing-frog, the motions of these detached rays are very peculiar. Two are considerably in advance of the eyes, almost close to the upper lip; the posterior of these is articulated by a stirrup upon a ridge of the base, but the anterior one is articulated by a ring at its base, into a solid staple of the bone, thus admitting of free motion in every direction, without the possibility of displacement, except in case of absolute fracture. The third one, which is on the top of the cranium behind the eyes, is articulated much in the same manner as the posterior one of the other two; and, of course, though these two have considerable motion in the mesial plane of the fish, they have a very little in the cross direction. The one near the lip, however, can be moved with nearly the same ease and rapidity in every direction; and, while the others terminate in points, it carries a little membrane, or flag, of brilliant metallic lustre, which the fish is understood to use as a means of alluring its prey; and the position of the flag, the eyes, and the mouth, certainly would answer well for such a purpose. The gill-membrane forms a large sac, opening in the axilla of the pectorals, supported by six very long rays, and with a small operculum. They have only three gills on each side. It is said that these fishes lurk in the mud, where, by agitating the rays on their heads, they attract smaller fishes, which mistake the appendages upon the rays for worms, and which are instantly seized, and transferred to the gill-sac. Their intestines have two or three short cœca near the commencement, but the fishes have no air-bladders."

L. Piscatorius, the Fishing-frog, Sea-devil, and many other local names, attains sometimes the length of four or five feet, and the extreme hideous-

ness of its appearance has procured it some celebrity. Such is its propensity to keep its great mouth in exercise, that, when captured in a net along with other fishes, it speedily begins to swallow its companions, especially if flounders, which appear to be its favorite food. On some coasts it is sought for on account of the live fish in its stomach, its own flesh being but small in quantity, and held in little estimation.

The Sea-devil is a slow swimmer, and would often be obliged to fast if it did not resort to stratagem. Crouching close to the ground, it stirs up the sand or mud, and, hidden by the obscurity thus produced, attacks many a prize by leisurely moving to and fro the two slender and elongated appendages on its head, the first of which, the better to deceive, is broad and flattened at the end, inviting pursuit by the shining, silvery appearance of the dilated part.

"*CHIRONECTES*. — These have, like the last genus, free rays on the head, of which the first is small, and often terminating by a tuft; and those behind it are enlarged by a membrane, which is sometimes very broad, and at other times they are united into a fin. Their body and head are compressed, and their mouth opens vertically. Their gill-membranes have four rays, and have no opening but a small hole behind the pectorals. Their dorsal extends along the whole back, and they often have cutaneous appendages all over their bodies. They have four gills, a large air-bladder, and a moderate intestine without cœca. They can inflate their great stomach with air, in the same manner as the Tetrodons blow up their bellies like balloons. On the ground, their two pairs of fins enable them to crawl along like quadrupeds; and the pectorals, in consequence of their position, perform the functions of hind legs. They can live out of the water for two or three days. They are found only in the seas of warm countries, and Æneas confounded many of them under the name of *L. histrio*. In some of the muddy estuaries on the north coast of Australia, from which the tide ebbs far back in the dry season, these frog-fishes are so abundant, and capable of taking such vigorous leaps, that those who have visited the places have, at first sight, taken them for birds."

The Frog-fish of the Asiatic Islands and the Southern Hemisphere is not more remarkable for its hideous deformity than for its capacity of leading a terrestrial life. Not only can it live several days out of the water, but it can crawl about the room in which it is confined — a facility which it owes to the great strength and the peculiar position of its pectoral fins, which thus perform the office of feet. The whole aspect of these grotesque-looking creatures, particularly in a walking position, is so much like that of toads or frogs, that a careless observer would, at first, be at some loss to determine their real nature.

MALTHUS.—These have the head greatly extended and flattened, principally by the projection of the sub-operculum; the eyes are forwards; the snout projecting, with a little horn; the mouth under the muzzle, of mean size, and protractile; the gills sustained by six or seven rays, and opening by a hole above each pectoral. They have a simple dorsal, which is soft and small, and there are no free rays in the head. The body is studded with osseous tubercles, and bordered round with cirri. They have neither coeca nor air-bladder.

The remaining genus of this family is *Batrachus*, the Frog-fishes, properly so called. They have the head flattened horizontally, and much larger than the body; the gape deeply cleft; the operculum and sub-operculum spinous: six gill-rays; the ventrals straight, attached under the throat, with only three rays, of which the first is broad and lengthened; the pectorals are carried by a short arm, resulting from an elongation of the carpal bones; their first dorsal is short, supported by three spinous rays; the second is soft and long, and has the anal corresponding to it; their lips are often garnished with filaments; their stomach is an oblong sac; their intestines are short, and without coeca; and their air-vessel is anteriorly deeply forked. They lurk in the sand, in order to swallow small fishes, in the same manner as the members of the last genus; and it is thought that wounds inflicted by their spines are dangerous. They inhabit both oceans. In some the scales are smooth, and they have a membrane over the eye. Others are scaly, and want that membrane.

LABRIDE.—Rock-fish tribe. *The Fourteenth Family of the Order Acanthopterygii.*

In this family are found several of our most valuable and delicious table-fishes. They have generally an oblong body, covered with scales, and a single dorsal, supported anteriorly by spinous rays, often furnished with membranous laminæ. The jaws are covered by fleshy lips. There are three bones in the pharynx—two upper ones attached to the cranium, and a large under one. All the three are furnished with teeth, arranged like a pavement in some, and pointed, or in laminæ, in others, and of unusual strength.

The *Labridæ* are a numerous family, constituting two great genera, many sub-genera, and a multitude of species.

LABRUS.—The characteristics of this genus are an elongated body, covered with large, thin scales; a single dorsal fin, extending nearly the whole length of the back, part of the rays spinous, the others flexible; behind the point of each spinous ray, a short filament; lips large and fleshy, whence the generic name of *Labrus*; teeth conspicuous, conical, sharp; cheek and operculum covered with scales; pre-operculum and operculum without serrations or spines.

In the summer of 1869, I had an opportunity, through the politeness of J. A. D. Worcester, Esq., proprietor of the Mattapoisett House, Mattapoisett, Mass., of examining the three following species of *Labri*, which were caught in Buzzard's Bay, directly in front of that popular hotel, where they are usually very abundant:—

L. americanus. — The Black-fish, or Tautog. The favorite haunts of this fish appear to be among the rocks of Mattapoisett Harbor, and the waters in the vicinity of New Bedford. The species exhibits a considerable variety of markings, although generally it is bluish-black above, varied with bands and blotches, which become darker towards the abdomen, which is whitish. The head is nearly without scales; lips thick and fleshy; eyes circular; pupils blue-black; and the lateral line rises just above the operculum, and curves with the body. The pectoral fins are of the color of the abdomen, and rounded at the extremity. The ventrals are situated a short distance back of the pectorals, and are dark-colored above, and white beneath.

The excellence of this fish has caused it to be transferred into Massachusetts Bay, where it seems to flourish quite as well as in the more southern waters, large numbers being taken annually all along the coast. The Tautog varies much in size, very large specimens being sometimes met with. A few years ago one was taken in Mattapoisett Harbor, which weighed fourteen pounds and three ounces. The flesh is very delicate, and in great demand among epicures.

L. Squeteague. — The *Otolithus regalis* of Cuvier. Weak-fish, or *Squeteague*.

Dr. Storer, in his report on the Fishes of Massachusetts (1837-8), says,—

" This species, which was, some years since, found in large numbers about Nantucket and Martha's Vineyard, has, of late, entirely disappeared. Dr. Yale, of Holmes' Hole, writes me, 'The *Squeteague* has deserted these waters; there has not been one taken for three or four years about here; they left about the time the *Blue-fish* came.' Hon. H. Barnard, of Nantucket, also says, 'The *Squeteague*, or Weak-fish, have disappeared since the return of the *Blue-fish*, which are their avowed enemy. Our fishermen say they have not seen one for six years.' Thus it appears, that while the *Blue-fish* was absent, they were abundant, and at the appearance of the *Blue-fish*, they left us."

I have no reason to doubt the general correctness of this statement regarding the eccentric movements of the *Squeteague*, — their long and mysterious absence from their usual haunts, — but I am quite sure the cause must be sought for in something very different from the one here assigned,

inasmuch as the *Blue-fish* and *Squeteague* are now (1869) both found abundantly in the same localities; and I have recently sat at a table where both these fishes (caught in the same waters) were comprised in the bill of fare.

Dr. Mitchell's description of this fish is as follows:—

"Size commonly from a foot to fifteen inches." (I have seen one nearly two feet long.) "He never goes into fresh streams, or ponds, but, within the limits of the salt water, is taken in almost all the places where *rock-fishes* are caught. The *Weak-fish* is so much the companion of the *basse*, that I once gave him the specific name of *Comes*. Head and back brown, with frequently a tinge of greenish. The spaces towards the sides faintly silvery, with dusky specks. These gradually disappear on the sides, until, on descending to the belly, a clear white prevails from the chin to the tail. Mouth wide. Jaws toothed, and, in the upper mandible, one, two, or three teeth in front, larger and stronger than the rest, and resembling the fangs of serpents. Throat, in front of the œsophagus, armed above and below with collections of small teeth. Eight softish rays in the foremost dorsal fin. Pectoral, dorsal, and caudal fins light or pale brown, inclining sometimes to yellowish. Anal and ventral fins pale yellow. Tail even. Lower jaw longer than the upper. Lateral line arched upwards, and, after its descent, runs quite to the extremity of the caudal fin. Tongue yellow, with minute black dots around the fore part; concave, with a soft and flexible margin; has a frœnum. The swimming-bladder is convertible to a good glue. I have eaten as fine blanc-mange from it as from the isinglass of the *sturgeon*. He is a fish of a goodly appearance, and is wholesome and well tasted, though rather soft. Is brought to market in great numbers during the summer months. He is taken by the line and the seine. He is called *Weak-fish*, as some say, because he does not pull very hard after he is hooked; or, as others allege, because laboring men, who are fed upon him, are *weak*, by reason of the deficient nourishment in that kind of food."

"Certain peculiar noises under water, of a low, rumbling, or drumming kind, are ascribed by the fishermen to the *Squeteague*. Whether the sounds come from these fishes or not, it is certain that, during their season, they may be heard coming from the bottom of the water, and in places frequented by *Weak-fish*, and not in other places; and when the *Weak-fish* depart, the sounds are no more heard."

In this last peculiarity, it shows a relationship to *Pogonias*, the Drum-fish.

L. Versicolor. — *Pugrus argyrops* (Cuvier). — Scup, Porgee, Seapaug. The length of the Porgee, or Scup, is from eight to twelve inches. The general color is a lustrous silvery, varied with reddish-brown and blue.

The dorsal fin is composed of twenty-four rays—twelve spinous and twelve membranous. It abounds in Buzzard's Bay, and large quantities are also taken at New Bedford, Holmes' Hole, and in the Vineyard Sound, which supply the Boston market. It is always a favorite on the table.

The European seas furnish several species. *L. maculatus*, the Balloon Wrasse, is a foot or eighteen inches long, with twenty or twenty-one spines in the dorsal. Its color is blue or greenish above, white below, marked all over with yellow, and sometimes the yellow predominates.

This species is numerous upon the British shores, though they are not very often caught; and, from the variations of their colors, they are not easily identified. They frequent deep pools among the rocks, hide themselves in fuci, and are understood to feed chiefly on crustacea. If the fishermen know their haunts, they take a bait freely; and, according to the report of Mr. Couch, the first taken are always the largest. They frequent the rocky shores only. They spawn in April; and the fry, which are then of small size, remain among the rocks during the summer. It is understood that the blue color, which appears to be characteristic of the high condition of the fish, is very evanescent. *L. lineatus*, the Lineal-streaked, is more clouded, has irregular bands along the flank, the ground of which is reddish, and the dorsal spines are less numerous, and the soft part of the fin lower, than in the former species. This species is named as a British fish, but it appears to be exceedingly rare. *L. variegatus*, the Blue-streaked, is one of the most beautiful of the family, of an orange red, paler on the belly, having the sides and irides striped with fine blue. The lips are capable of great extension, and there is a single row of pointed teeth in each jaw. It is found in the British seas, but only on the south and south-west coasts. *L. vetula* is dark purple, black on the upper part, paler on the belly, and has the fore part of the head flesh-colored, tinged with purple, and the eyelid blue. *L. carneus*, the Three-spotted Wrasse, reddish in the color, with four light spots, and three black ones intermediate, extending from the middle of the dorsal to the root of the caudal. It belongs to the Mediterranean, but has been found on the Channel-coast of England, in the Firth of Forth, and even on the coast of Norway, and in the Baltic.

Among the sub-genera are the following, which are all foreign, with one exception:—

Chellinus, differs from *Labrus*, properly so called, in having the lateral line interrupted at the end of the dorsals, where it recommences a little lower down. They are beautiful fishes, inhabiting the Indian seas.

Lachnolaimus (Captains), have the general characteristic of *Labrus*; but their pharynx has no pavement-like teeth, except in the posterior part, the remainder of them, as well as a part of the palate, being covered with a

villous membrane. They are easily known by the first spines of the dorsal, which extend in long, flexible threads. They are American fishes.

Julis have the head entirely without scales, and the lateral line forming a curve near the end of the dorsal. There are some in the Mediterranean, but they are more numerous in the tropical seas. They are generally small, but beautiful fishes: some are violet, some bright scarlet, some rich green, and some marked with golden color; and those which have the caudal fin rounded, or truncated, have the first dorsal rays extended in long filaments.

Acanthopuses have the characteristics of the last, with the exception of two flat teeth, which project from the mouth, and curve upwards. The two known species are from the Indian seas.

Orenilabrus.—They have the true characteristics of *Labrus*, both external and internal, and differ only in having the border of the pre-operculum toothed. Some species are found in the North Sea,—such as *Lutjanus ru-prestis* of Bloch, yellow, with clouded bands ranged vertically, and blackish; *L. Norvegicus*, brownish, irregularly marked with deep brown; *L. melops*, orange, spotted with blue, and a black spot behind the eye; *L. exoletus*, remarkable for five spines in the anal fin. The Mediterranean furnishes a number, most beautifully colored, the most splendid of which is *L. lapina*, silvery, with three broad longitudinal bands, composed of vermillion dots, with the pectorals yellow, and the ventrals blue. They are also abundant in the tropical seas; and many species, hitherto included in the genus *Labrus*, ought to be placed here. Several species of this sub-genus occur in the British seas, the chief of which are—*Orenilabrus tinca*, the Gilt-head; *C. corneticus*, the Gold-simy; *C. gibbus*, the Gibbous Wrasse; and *C. leusias*, the Scale-rayed Wrasse; but they are all small fishes, in little or no estimation.

Coricus.—This sub-genus has all the characteristics of the last, in addition to which the mouth is little less protractile than in the next. Only one small species is known, which inhabits the Mediterranean.

Epibulus.—These fishes are remarkable for the extreme extension which they can give to their mouth by means of a see-saw motion of their maxillaries, and the sliding forward of the intermaxillaries, which instantly forms a kind of tube. They make use of this artifice for seizing small fishes which pass near this curious instrument; and the same artifice is resorted to by the *Coreyi*, the *Zei*, and the *Smares*, according to the degree of protractility of the mouth. The entire body and head of this sub-genus are covered with large scales, the last track of which advances upon the anal and caudal fins, as in *Cheilinus*. The lateral line is similarly interrupted as in the latter; and, as in *Labrus*, there are two long conical teeth in the

front of each jaw, followed by smaller blunt ones. The known species is from the Indian seas, and is of a reddish color.

Clepticus. — This sub-genus has a small cylindrical snout, which is suddenly advanced forward, but which is not so long as the head. The teeth are small, and barely perceptible to the touch; the body is oblong; the lateral line continuous; and the dorsal and anal are enveloped in scales nearly to the top of the spines. One species, of a red-color, and from the West Indies, is the only one known.

Gomphosus. — These *Labridæ*, with the head entirely smooth, as in *Julis*, have the muzzle in the form of a tube, composed of the prolonged maxillaries and intermaxillaries, as far as the small opening of the mouth. Several species are taken in the Indian Ocean, and the flesh of some is considered delicious.

SCARUS. — The Scari resemble the *Labridæ* in their oblong form, large scales, and an interrupted lateral line. Several species are found in tropical seas, which, on account of their brilliant colors, and the form of their jaws, are called Parrot-fishes. One species, *S. creticus*, inhabits the Archipelago, and is remarkable for the change that takes place in its color, being at one season blue, and at another, red. This fish was much valued by the ancients; and the Roman admiral, Elipertius Optatus, during the reign of Claudius, went to Greece to obtain it, and distribute through the Italian seas.

FISTULARID.E. *The Fifteenth Family of the Order Acanthopterygii.*

According to Yarrell, the characteristics of this tribe are as follows: —

A single dorsal, most of which, as well as of the anal, is composed of simple rays. The intermaxillaries and the lower jaw are armed with small teeth. From the two lobes of the caudal proceeds a filament which is sometimes as long as the body. The tube of the snout is very long and depressed; the scales are invisible. There are two genera.

FISTULARIA (Pipe-mouths). — They have a cylindrical body. Their head is equal to a third or a fourth of the length of the whole body, which is itself long and slender. One species, *F. serrata*, is sometimes found on our shores. There are several varieties of these fishes, one of the most remarkable of which is the *F. Chinensis*, or Chinese Tobacco-pipe Fish. They are curious creatures, but of no value to man.

BONY FISHES. ORDER II.—MALACOPTERYGII
ABDOMINALES.

CYPRINIDÆ.—The Carps. *First Family of the Malacopterygii Abdominales.*

The fishes of this family have a shallow mouth, feeble jaws, often without teeth, and the margin formed by the outer maxillaries; but they have the pharynx strongly toothed. They have few gill-rays, a scaly body, and are the least carnivorous of the whole class, feeding on seeds, roots of plants, and mud, and the slimy substance which gathers on the rocks in fresh waters. It is a numerous family, at the head of which is the genus

CYPRINUS.—The Carps have a small mouth, without a single tooth, three flat gill-rays. They have a smooth tongue. "Their pharynx is a powerful instrument of mastication, having strong teeth on the inferior pharyngeal bones; and they bruise their food between these and a strong disk, which is set in a large cavity under a process of the sphenoid. They have a long dorsal fin, the second ray of which, as well as that of the anal, is armed with a strong spine.

C. Carpio.—The Common Carp. This fish is of an olive-green color above, yellowish below. It bears transportation, or rather colonization, better than any of the class; and, from its home in Central Europe, it has found its way into the lakes and rivers of both continents. It was introduced into England by Leonard Maschal, about the year 1514. Carp are very long-lived. Gesner brings an instance of one that was a hundred years old. They also grow to a very great size. These fish are extremely cunning, and on that account are by some styled the *River Fox*. They will sometimes leap over the nets, and escape that way; at others, will immerse themselves so deep in the mud, as to let the net pass over them. They are also very shy of taking a bait; yet, at the spawning time, they are so simple as to suffer themselves to be tickled and caught by anybody that will attempt it. It is so tenacious of life that it may be kept alive for a fortnight in wet straw or moss.

C. Auratus.—The Golden Carp. These are the Gold-fishes and Silver-fishes of our aquariums. They are black when young, but by degrees acquire the golden red for which they are esteemed, though some of them are silvery, with various clouds of all the three colors. Some have no dorsal; others, a very small one; others, again, have a caudal of three or four lobes; and others still, very large eyes,—all of which varieties are merely accidental, and the results of that artificial treatment which they receive when

kept in glass vessels for ornamental purposes. They flourish in our northern ponds and streams, and bear well the rigors of the climate.

They are the pets of ladies, who complain that, like all other beautiful things, they die early. They are careful to change the water, and keep them clean, but forget that the Carp is a semi-carnivorous animal, with a sharp appetite, and as much in danger of starving to death in his narrow quarters as a land animal. In confinement, however, it is best to give them animal food, such as worms, only occasionally, and let their principal fare be of pellets of stiff dough, made of flour and water only. All the food that remains uneaten should be removed.

BARBUS.—The Barbel, or Bearded-fish, is so named from the cirri at its mouth. *B. communis*, the common Barbel, known by its long head, was so coarse as to be overlooked by the ancients till the time of Ausonius, and what he says is no panegyric on it; for he lets us know it loves deep waters, and that, when it grows old, it was not absolutely bad. It frequents the still and deep parts of rivers, and lives in society, rooting, like swine, with its nose in the soft banks. It is so tame as to suffer itself to be taken with the hand; and people have been known to take numbers by diving for them. In summer they move about during night in search of food, but towards autumn, and during winter, confine themselves to the deepest holes. They are the worst and coarsest of fresh-water fish, and seldom eaten but by the poorer sort of people, who sometimes boil them with a bit of bacon, to give them a relish. The roe is very noxious, affecting those who unwarily eat of it with a nausea, vomiting, purging, and a slight swelling. It is sometimes found of the length of three feet, and eighteen pounds in weight; it is of a long and rounded form; the scales not large. Its head is smooth; the nostrils placed near the eyes; the mouth is placed below. On each corner is a single beard, and another on each side the nose. The dorsal fin is armed with a remarkably strong spine, sharply serrated, with which it can inflict a very severe wound on the incautious handler, and even do much damage to the nets. The pectoral fins are of a pale brown color; the ventral and anal tipped with yellow; the tail a little bifurcated, and of a deep purple; the side line is straight; the scales are of a pale gold color, edged with black; the belly is white.

GOBIO.—The Gudgeons. The Gudgeon is generally found in gentle streams, and is of a small size; those few, however, that are caught in the Kennet and Coln Rivers, in England, are three times the weight of those taken elsewhere. The largest we ever remember to have heard of was taken near Uxbridge, England, and weighed half a pound. They bite eagerly, and are assembled by raking the bed of the river; to this spot they immediately crowd in shoals, expecting food from this disturbance. The shape

of the body is thick and round; the irides tinged with red, the gill-covers with green and silver. The lower jaw is shorter than the upper; at each corner of the mouth is a single beard; the back olive, spotted with black; the side line straight; the sides beneath that silvery; the belly white. The tail is forked; that, as well as the dorsal fin, is spotted with black.

ABRAMIS. — The Bream. There are two species — the Carp Bream and the White Bream. The first is largest, and most highly esteemed; and the other is of no value except as food for more interesting and valuable species.

The Carp Bream is found in all the great lakes, and in rivers which have a gentle current, and a bottom composed of marl, clay, and herbage; and it abides in the deepest parts. It is taken mostly under the ice; and this fishery is so considerable that, in some of the lakes belonging to Prussia, there have been taken to the value of two hundred pounds at a time; they are also caught in great quantities in Holstein, Mecklenburg, Livonia, and Sweden. In a lake near Nordkiöping, there were taken at one time, in March, 1749, no less than fifty thousand, weighing eighteen thousand two hundred pounds. It is extremely deep, and thin in proportion to its length. The back rises much, and is very sharp at the top. The head and mouth are small. The scales are very large; the sides flat and thin. The dorsal fin has eleven rays, the second of which is the longest; that fin, as well as all the rest, are of a dusky color; the back of the same hue; the sides yellowish. The tail is very large, and of the form of a crescent.

CASTOSTOMUS. — The Suckers. This genus has a single dorsal fin; gill-membranes three rayed; head and operculum smooth; jaws toothless and retractile; mouth beneath the snout; lips plaited, lobed, or carunculated, suitable for sucking; and throat with pectinated teeth.

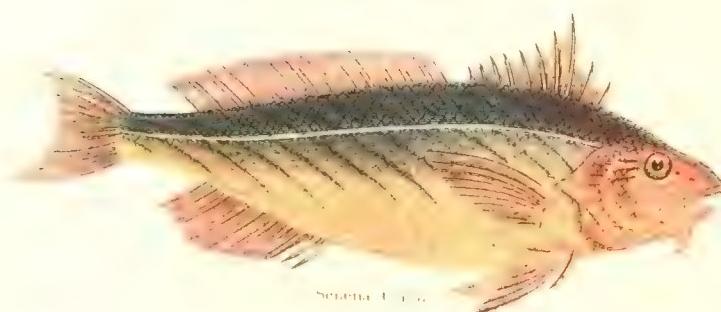
All of the species are American, and very common in our rivers and ponds. Although not much prized by fishermen, I have often eaten them, and found them very palatable. The Black Sucker (*C. nigricans*), however, is the best for the table. They appear to feed on the slimy substance which gathers on the surfaces of rocks, logs, and other objects sunk in the rivers. I have frequently seen long rows of them attached by their sucking mouths to these sludgy surfaces, their fins slightly agitated, and their bodies undulating in the current, reflecting the sunbeams in numerous lustrous and beautiful combinations.

C. Bostoniensis. — This is the common Sucker, too well known to every boy of the United States to need description.

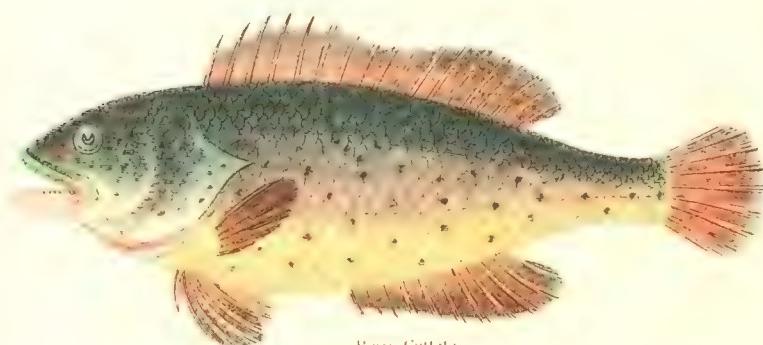
C. Tuberculatus. — The Horned Sucker. Although this fish has been taken in the rivers and ponds of the New England States, it is not very common. Le Sueur describes a specimen found in Pennsylvania. It



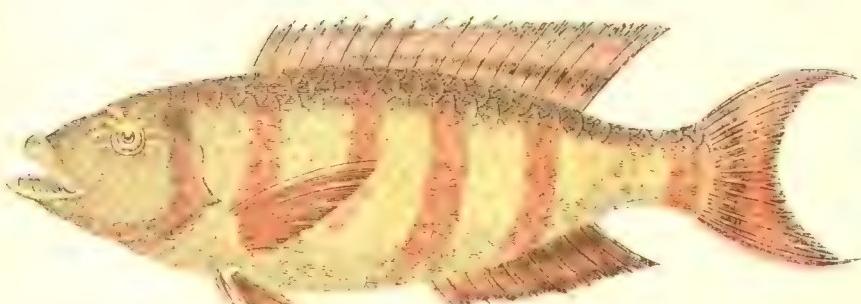
Cod. *Gadus*.



Scorpion Fish.



Grouper. *Cutifaria*.



Sparus faciatus.
Chandler's Gilt Head.

is about fourteen inches in length, color dark brown above, yellowish on the sides, and white beneath; scales large, with golden reflections. The pectoral fins are reddish, tipped with brown, and the ventrals are of the same color. But the distinguishing characteristic of the species is its tuberculated or horned snout.

C. Gibbosus.—The Gibbosus Sucker. This species was discovered by Le Sueur, in the Connecticut River, and he thus describes it:—

"Back elevated in front of the dorsal fin, which is almost as high as broad, and rounded; anal fin bilobated; head nearly as high as long; snout short, roundish; tail straight; caudal fin semi-lunated; lobes roundish, the inferior one longer than the upper. The color of the back is a deep blue, with golden reflections; pectoral, ventral, and anal fins of a fine reddish orange color; caudal fin tinted with carmine and violet; dorsal fin bluish-green; abdominal scales red at their base; lateral line hardly perceptible; body marked with four or five faint transverse bands. Length of the specimen, eleven inches."

This is a beautiful fish, but must be very rare, as I have never met with it in the rivers of Maine or New Hampshire.

C. Nigricans.—The Black Sucker. I am tempted here to introduce Dr. Storer's excellent description of this species. The specimen here described was about fifteen inches in length.

"Color of the back, black; sides reddish-yellow, with black blotches; beneath, white, with golden reflections. Scales moderate in size. Head quadrangular, one fifth the length of the fish; top of the head of a deeper black than the body. Eyes moderate, oblong; pupils black; irides golden. Mouth large; corrugations of the lips very large, particularly those of the lower lip. The lateral line, arising back of the operculum, on a line opposite the centre of the eye, makes a very slight curve downwards, and then pursues nearly a straight course to the tail; it is composed of sixty scales. Back, between the head and dorsal fin, rounded. The pectoral, ventral, and anal fins are reddish. The caudal and dorsal blackish. The dorsal fin in height is equal to two thirds its length. The third and fourth rays of the anal fin, which are longest, extend a little on to the rays of the caudal fin.

"In two of the eight specimens examined, there were but twelve rays in the dorsal fin.

"In larger specimens than that just described, the back is not black, but, together with the sides, is of an olive-brown color; in others, again, the back is neither black nor olive-brown, but reddish, like the sides. In some specimens, a longitudinal band, of a deeper red than the rest of the side, runs the whole length of the fish, just beneath the dark-colored back. The

golden tints reflected from the opercula, and the scales along the entire sides of this species, give it a very brilliant appearance."

LEUCISCUS.—This group has a short dorsal and anal fin; no spines, cirri, or peculiarities of the lips; the species are numerous, but not much valued.

L. Cryssoleucas.—The New York Shiner. This is a handsome species, but not held in high esteem, except as bait for pickerel and other fish. It is from six to seven inches long; the prevailing color is bright golden; the top of the head and the back are black; gill-covers more brilliant than the sides. The dorsal fin is of a light-brown color; the pectorals are yellowish, except the upper rays, which are of a dusky black.

L. Argenteus.—The Silvery Leuciscus. This species is about six inches in length, of a shining silvery color, darker on the back, and the top of the head is blue.

L. Pulchellus.—The beautiful Leuciscus. This is a larger species, and quite common in our ponds and streams. I have seen it in great numbers in the rivers of Maine, have caught it on numerous occasions, and have frequently eaten it, fried, as the perch is generally cooked, and found it a very agreeable food. Its length is from twelve to fourteen inches; the top of the head is bluish; the gill-covers silvery, with flesh-colored tints; the sides and abdomen of a beautiful flesh color, tinged with golden reflections, and the back is of a dark brown.

L. Atronasus.—The Brook Minnow. There are few who are not familiar with this pretty little fish, multitudes of which may be seen at almost any time sporting in the shallow waters of our streams and ponds. They are from one to two inches in length. The upper part of the body is of a greenish hue; a black band passes along the sides to the tail; the parts beneath this band are white. The gill-covers are silvery, radiating gold rays. These tiny creatures present a very pleasing appearance when they are swimming in the sunshine, darting here and there in pursuit of their food, or in the wantonness of play.

HYDRARGIRA.—This genus is characterized by teeth in the jaws and throat; protractile jaws; head flat, shielded above with large scales; the ventral fins have six rays.

H. Nigro-fasciata.—The Banded Minnow, a pretty little fish, two inches long, of a golden-green color above, and a silvery-white beneath; *H. ornata*, the Ornamented Minnow, nearly three inches long, found plentifully in the creeks along the coast, of a dark-brown color on the back, belly white, and sides brown, with metallic reflections; and the *H. flavula*, the Basse Fry, compose the group. The latter species is about five inches in length. The upper part of the body is yellowish-green, the under part a brilliant yellow,

and on each side are four dark-colored bands, running almost the whole length of the fish. It derives its name from the resemblance of the bands, which mark its body, to those of the "Striped Basse."

ESOCIDÆ.—The Pike Tribe. *Second Family of the Malacopterygii Abdominales.*

The members of this family, with one exception, have the dorsal fin far back, opposite the anal. Many species are found in fresh waters, and all are extremely voracious. At the head of the series is placed the genus

Esox.—The Pikes. They have an oblong, obtuse, and broad muzzle, and small intermaxillaries, furnished with small, pointed teeth in the middle of the upper jaw, where they form two rows. The vomer, palatals, tongue, pharynx, and gill-arches are "roughened with teeth, like a card;" and they have in the sides of the under jaw a row of long and pointed teeth.

E. Lucius.—The Common Pike. This fish is noted in Europe for its large size, strength, fierceness, and voracity. Its flesh is good, and easy of digestion, and it is consequently a favorite dish on the table. It is common in most of the lakes of Europe, but the largest are those taken in Lapland, which, according to Schaeffer, are sometimes eight feet long. They are taken there in great abundance, dried and exported for sale. According to the common saying, these fish were introduced into England in the reign of Henry VIII., in 1537. They were so rare, that a pike was sold for double the price of a house lamb in February, and a pickerel for more than a fat capon. All writers who treat of this species bring instances of its vast voraciousness. We have known one that was choked by attempting to swallow one of its own species that proved too large a morsel. Yet its jaws are very loosely connected, and have on each side an additional bone, like the jaw of a viper, which renders them capable of great distention when it swallows its prey. It does not confine itself to feed on fish and frogs; it will devour the water-rat, and draw down the young ducks, as they are swimming about. At the Marquis of Stafford's Canal, at Trentham, England, a pike seized the head of a swan, as she was feeding under water, and gorged so much of it as killed them both. The servants, perceiving the swan with its head under water for a longer time than usual, took the boat, and found both swan and pike dead. But there are instances of its fierceness still more surprising, and which, indeed, border a little on the marvellous. Gesner relates that a famished pike in the Rhone seized on the lips of a mule that was brought to water, and that the beast drew the fish out before it could disengage itself; that people have been bit by these voracious creatures while they were washing their legs; and that they will even

contend with the otter for its prey, and endeavor to force it out of its mouth. Yet, it is said that the pike, with all its strength and ferocity, is no match for a trout of equal weight, the greater velocity of the latter fish giving it the advantage.

E. Reticulatus.—The American Pickerel. This fish is found in all parts of our country, and is one of the most popular objects of the angler's pursuit. It derives its specific name from the network of brownish lines which covers nearly the whole body. The color varies in different localities, being in some places of a brilliant gold color, and in others of a greenish-brown. Specimens are often taken weighing from six to eight pounds.

Another American species is the *E. estor*, which is sprinkled with round, blackish spots.

BELONE.—Yarrell gives the following generic characteristics:—

"Head and body extremely elongated; the latter covered with minute scales; both jaws very much produced, straight, narrow, and pointed, armed with numerous small teeth."

B. Truncata, the Gar-fish, is frequently found on our shores from ten to fifteen inches in length. Dr. Storer describes a specimen as of a light-green color above, and beneath, a clear silvery-white. There are some species eight feet in length, which bite very severely. The flesh is good and wholesome, although some persons refuse it on account of the greenish color of the bones.

SCOMBERESOX.—The generic characteristics of the group are the same as the former, save that the posterior portions of the dorsal and anal fins are divided, forming finlets, as in the mackerel. The species are gregarious, and are followed and preyed upon by porpoises, the tunny, and other large members of the mackerel family.

S. Equirostrum.—The Bill-fish. This is the only species, we believe, found in American waters. A few years ago, I found it in large numbers in the waters of Cape Cod, and suppose it to be equally plentiful there now. It approaches the coast about the middle of autumn, and is welcomed as an agreeable and wholesome article of food. It is from eight to twelve inches in length. The upper part of the back is of a yellowish-green color; a silvery band, half an inch wide, and divided in its centre by a line of the same color as the back, runs the whole length of the body. The belly is silvery, with a coppery tinge.

EXOCETUS.—The Flying-fish. These fishes are provided with pectoral fins of so great a length, as to be able to carry them, like wings, a great distance through the air. According to Mr. George Bennet ("Wanderings in New South Wales"), they cannot raise themselves when in the atmosphere, the elevation they take depending entirely on the power of the first

spring or leap they make on leaving their native element. Their flight, as it is called, carries them fifteen or eighteen feet above the water, and the lines which they traverse when they enjoy full liberty of motion, are very low curves, and always in the direction of their previous progress in the usual element of fishes. Their silvery wings and blue bodies, glittering beneath the rays of a tropical sun, afford a most beautiful spectacle, when, as is frequently the case, they rise into the air by thousands at once, and in all possible directions. The advantage afforded them by their wing-like fins, in escaping from the pursuit of the bonitos and albacores, often, however, leads to their destruction in another element, where gulls and frigate-birds frequently seize them with lightning-like rapidity ere they fall back again into the ocean. It is interesting to observe a bonito swimming beneath the feeble aeronaut, keeping him steadily in view, and preparing to seize him at the moment of his descent. But the Flying-fish often eludes the bite of his enemy by instantaneously renewing his leap, and not unfrequently escapes by extreme agility.

The specific gravity of the Flying-fish can be most admirably regulated in correspondence with the element through which it may move. The swimming-bladder, when distended, occupies nearly the entire cavity of the abdomen, thus containing a large volume of air; and, in addition to this, there is a membrane in the mouth which can be inflated through the gills. The pectoral fins, though so large when expanded, can be folded into an exceedingly slender, neat, and compact form, so as to be no hinderance to swimming. A light displayed from the chains of a vessel in a dark night will bring many Flying-fishes on board, where they are esteemed as a great delicacy. Their fate, thus to be persecuted in both elements, and to find security nowhere, has often been pitied in prose and verse; but, although they excite so much sentimental commiseration, they are themselves no less predaceous than their enemies, feeding chiefly on smaller fishes.

The Flying-fish of the West-Indian waters is frequently allureed by the tepid waters of the Gulf Stream into higher latitudes, and Pennant cites several examples of its having been found near the British coast.

One species, *E. volitans*, is common in the Atlantic, and is said to have the power to leap more than two hundred yards in distance, and upwards of twenty feet in height. It sometimes, but rarely, visits our shores.

SILURIDÆ (Sheat-fish). *Third Family of the Malacopterygii Abdominales.*

"These fishes are distinguished from all the rest of the order by the want of true scales, having only a naked skin, or large bony scales. The intermaxillaries, suspended under the ethmoid, form the margin of the upper

jaw; and the maxillary bones are either simple vestiges, or extended into cirri. The intestinal canal is large, folded, and without cæca. The air-bladder is large, and adheres to a peculiar apparatus of bones. A strong, articulated spine generally forms the first ray of the dorsal and the pectorals; and there is sometimes an adipose dorsal behind the other, as in the Salmon Family.

"*SILURUS*.—These form a numerous genus, known by the naked skin, from the mouth being cleft in the end of the muzzle, and from a strong spine in the first ray of the dorsal. This spine is articulated only to the bones of the shoulder, and the fish can at pleasure lay it flat on the body, or keep it fixed in a perpendicular direction, in which case it is a formidable weapon, and wounds inflicted by it are understood to be poisoned; which opinion has arisen from tetanus sometimes following the wound, not from poison certainly, but from the ragged nature of the wound itself.

"These fishes have the head depressed; the intermaxillaries suspended under the ethmoid, and not protractile; the maxillaries very small, but almost always continued in barbules attached to the lower lip, and also to the nostrils; the covering of their gills is without sub-operculum or gill-flap; their air-bladder, strong and heart-shaped, is attached, by its two upper lobes, to a peculiar bony structure, which again is attached to the first vertebra; the stomach is a fleshy *cul-de-sac*, having the intestinal canal long and wide, but without cæca. They abound in the rivers of warm countries; and seeds of plants are found in the stomach of many of their species.

"*SILURUS*, properly so called, with only a small fin of four rays on the fore-part of the back, but with the anal very long, and approaching very close to the base of the caudal. There is no obvious spine in the dorsal; and the teeth in both jaws, and in the vomer, are like those of a card. *S. glanis*, the Sly Silurus, is the largest fresh-water fish of Europe, and the only member of the genus in this quarter of the world. It is smooth, of a greenish-black, spotted with black above, and yellowish-white below; head large, with six cirri—two large ones near the nostrils, and four shorter on the lower jaw. It sometimes grows to six feet in length, and weighs three hundred pounds. It is found in the slow-running rivers of Central Europe, and lurks in the mud to watch for its prey. Its flesh is greasy, and is sometimes employed as hog's lard. It is found in the rivers of Asia and Africa.

"*SCHILBUS* have the body vertically compressed, a strong-toothed spine in the dorsal, the head small and depressed, the nape suddenly raised, and the eyes low down. They have eight cirri, are found in the Nile, and their flesh is said to be less disagreeable than that of other members of the family."

PIMELODUS. — The body is covered with a naked skin ; no lateral armature ; jaws, and often palatine bones, furnished with teeth, but there is no band of teeth on the vomer parallel to that on the upper jaw. The form of the head varies very much, as well as the number of its barbules. There are several foreign species.

P. Nebulosus. — The Horned Pout. This is a well-known species in all of our rivers and ponds. It is often eaten, and is much esteemed by many, while others throw it away, not liking its appearance.

SALMONID.E. *Fourth Family of the Malacopterygii Abdominales.*

The genera and sub-genera of this family are too numerous to be recorded here. I shall confine my observations, therefore, to the most valuable of them.

SALMO. — The Salmons have the head smooth ; two dorsal fins, the first supported by rays, the second fleshy, and without rays ; teeth on the vomer, both palatine bones, and all the maxillary bones.

S. Salar. — The Common Salmon, which was known to the Romans, but not to the Greeks, is distinguished from other fish by having two dorsal fins, of which the hindmost is fleshy, and without rays ; they have teeth both in the jaws and the tongue, and the body is covered with round and minutely striated scales. Gray is the color of the back and sides, sometimes spotted with black, and sometimes plain. The belly is silvery. It is entirely a northern fish, being found both at Greenland, Kamtschatka, and in the northern parts of North America, but never so far south as the Mediterranean. Salmon are now scarce in all our rivers south of the Merrimac. In the Connecticut, they were once so abundant as to be less esteemed than shad ; and the fishermen used to require their purchasers to take some salmon with their shad. Within the memory of persons living, they were taken in plenty even as far up as Vermont. The Indians used to catch a great many of them as they were ascending Bellows Falls. It is supposed that the locks, dams, and canals, constructed in the river, have driven this valuable fish away. About the latter end of the year, the salmon begin to press up the rivers, even for hundreds of miles, to deposit their spawn, which lies buried in the sand till spring, if not disturbed by the floods, or devoured by other fishes. In this peregrination it is not to be stopped even by cataracts. About March the young ones begin to appear ; and, about the beginning of May, the river is full of the salmon fry, which are then four or five inches long, and gradually proceed to the sea. About the middle of June, the earliest fry begin to return again from the sea, and are then from twelve to fourteen inches long. Rapid and stony rivers, where the water is free from mud, are the favorite places of most of the salmon tribe, the whole of which is supposed

to afford wholesome food to mankind. These fish, when taken out of their natural element, very soon die; to preserve their flavor, they must be killed as soon as they are taken out of the water. The fishermen usually pierce them near the tail with a knife, when they soon die with loss of blood. The Scotch Commissioners of Fisheries, some years since, adopted an ingenious device for learning the migrations of the salmon. They marked a large number of fish, hatched from the spawn deposited the last year in the Tweed, by placing around them a belt or ring of India rubber, numbered and dated. One of the fish was caught, two days after being thus marked, and let go, a hundred miles from the mouth of the Tweed. All fishermen, taking such marked fish, were desired to take note of the weight, the place and date of capture, and various other particulars named in the directions. The idea is decidedly a novel and very amusing one, and may lead to valuable scientific discovery in regard to the habits of the salmon.

This valuable fish is not so abundant in the Eastern States of the Union as formerly, yet the rivers of Maine keep the markets pretty well supplied. Civilization, with the industrial enterprises which accompany it, is as destructive to many of our most valuable river fishes as to the aborigines, and the wild beasts of the forests. The manufactories and numerous dams, which interrupt their progress up the rivers, have greatly diminished their numbers. It is interesting to observe the efforts they make to overcome these obstructions, and the surprising leaps they sometimes make. I have seen them shoot like arrows over dams of a considerable height, and against a strong current.

S. Trutta. — The Salmon Trout. This species varies considerably in color. It is generally bluish-black above, pale on the sides, silvery on the belly, with cross-shaped spots towards the upper part.

The Sea Trout, or Salmon Trout, migrates, like the salmon, up several of our rivers, spawns, and returns to the sea. The shape is thicker than the common trout. The head and back are dusky, with a gloss of blue and green, and the sides, as far as the lateral line, are marked with large, irregular spots of black. The flesh, when boiled, is red, and resembles that of the salmon in taste.

Trout-fishing affords excellent diversion for the angler, and the passion for this pastime is very great. It is a matter of surprise that this common fish has escaped the notice of all the ancients, except Ausonius. It is also singular, that so delicate a species should be neglected, at a time when the folly of the table was at its height; and that the epicures should overlook a fish that is found in such quantities in the lakes of their neighborhood, when they ransacked the universe for dainties. The milts of *muraene* were brought from one place; the livers of *scari* from another; and oysters even

from so remote a spot as Sandwich; but there was, and is, a fashion in the article of good living. The general shape of the trout is rather long than broad; in several of the Scotch and Irish rivers they grow so much thicker than in those of England, that a fish from eighteen to twenty-two inches will often weigh from three to five pounds. This is a fish of prey, has a short, roundish head, blunt nose, and wide mouth, filled with teeth, not only in the jaws, but on the palate and tongue; the scales are small; the back ash-color; the sides yellow, and, when in season, it is sprinkled all over the body and covers of the gills with small, beautiful red and black spots; the tail is broad. The colors of the trout, and its spots, vary greatly in different waters, and in different seasons; yet each may be reduced to one species. It sometimes attains the weight of seven and a half pounds. In the Androscoggin River, Maine, two *brook* trout were taken by Mr. Bartlett, the author of "Familiar Quotations," at one cast of the fly, which weighed respectively seven and a half and four pounds. It is usually much smaller, and is much in request for the table. The large species of trout, which inhabit the larger lakes of Maine, New Hampshire, and those about the sources of the Susquehanna, have not yet been described or properly distinguished, that we are aware of; indeed, it is possible that more than one species has been confounded under the common trout. A gigantic species of trout from Lake Huron has been described by Dr. Mitchell. It is said to attain the weight of one hundred and twenty pounds. The flesh is remarkably fat, rich, and savory. The specific name *Amethystinus* was applied on account of the purplish tinge and hyaline tips of the teeth. We add some observations on the trout as an object of pursuit to the American angler. It is particularly abundant in New England, where the waters and soil, being of a more Alpine character, are highly congenial to the nature of this species of fish. They may be divided into three principal classes, namely, Pond Trout, River Trout, and Sea Trout. Of these, however, there are as many varieties and shades of difference as are known and described in England, Scotland, and other countries; but, for all the purposes of the angler, it is unnecessary to enumerate any others than those above mentioned. Pond or lake trout vary in shape and color. Their size is generally in proportion to the extent of the water in which they are taken. In Moosehead Lake, in Maine, they attain the enormous weight of forty or fifty pounds, and in the lakes of other States, are found of the average size of salmon. This large description of trout are seldom taken, except through the ice in winter, and consequently afford but little sport to the lover of angling. In the Winnipiseogee Lake, in New Hampshire, and Sebago Lake, in Maine, the average size of the fish is about that of the largest mackerel, which it also resembles in shape. The spots upon these and other

lake trout are seldom red, but dark and indistinct, according to their size. The last-mentioned lake is one of the few in which the fish are taken by the usual method of angling, for which they are more esteemed, as affording good sport, than for their flavor; and the common impression is, that these fish sprung from salmon, but that, having been prevented by obstructions in the river from entering the sea, they have become, by confinement, degenerated in size and quality, retaining only the color of the flesh. In the interior lakes of New York, and in the great lakes of the West, the trout grows to a vast size; but these lake trout, being coarse fish, and taken without skill, in the winter only, are held in no estimation by the scientific angler. River or brook trout are common in the New England States; but, much to the annoyance of the angler, they perceptibly diminish in proportion to the increase of mills and manufactories upon the various streams. The size of this class of trout, and the color of the skin and spots, are much alike in all, excepting that some are of a more silvery hue than others; and the color of the flesh varies, perhaps, as it has been observed, according to their different food, being sometimes perfectly white, sometimes of a yellow tinge, but generally pink. There are also trout in various small ponds, both natural and artificial, those taken from the latter being in all respects similar to the brook or river trout. This is to be understood of ponds in the interior, as there are many artificial ponds, situated near the sea-coast, at the head of inlets from the sea and tide water, where the fish are very little inferior in size and quality to those which are taken where the tide ebbs and flows. Of the three classes of trout referred to, there is none so much esteemed as the sea trout, which may be called migratory, in distinction from those which have no access to the salt water. In the early spring months, they are taken in great abundance in the various salt rivers, creeks, and tide waters upon the shores of New England and Long Island, but more particularly in the waters of Cape Cod, where the celebrated Waquoit Bay, with other neighboring waters, has long been the favorite resort of the scientific fisherman. As the season advances, these fish repair to fresh water, at which time, as well as earlier, they afford great diversion to the angler, by whom they are highly prized, not merely for their superiority of form, color, and delicious flavor, but for the voracity with which they seize the bait of the artificial fly, and their activity upon the hook. In the United States, as well as in Great Britain, this fish is the great object of the angler's art, the perfection of which is the use of the artificial fly.

S. Fontinalis. — The Common Brook Trout. I do not feel it necessary to describe this beautiful species, which, "in speckled pride," flourishes in all of our streams, and is the angler's special delight.

Osmerus. — This genus has two rows of teeth on each palatal, but only

a few in front of the vomer. Form is like that of the trout, and the body is of a brilliant, silvery color, with some greenish reflections, but without spots. The only species known in this country is

O. Eperlanus. — The Smelt. This is a pretty and delicious table-fish, and millions of them, taken with scoop-nets, are brought into our markets.

CLUPEIDÆ. Fifth Family of the Malacopterygii Abdominales.

The *Clupeidæ* have no adipose dorsal; their bodies are always scaly, and most of them have an air-bladder. Several of the species ascend rivers, and all periodically approach the shores. It yields in commercial value only to the mackerel and the cod. We have, at the head of the family, the genus

CLUPEA. — Yarrell gives the following characteristics of the genus:—

"Body compressed; scales large, thin, and deciduous; head compressed; teeth minute or wanting; a single dorsal fin; abdominal line forming a sharp, keel-like edge, which in some species is serrated."

C. Elongata. — This is the common English Herring of our markets. It is about a foot long, sometimes a little more. The color upon the back is of a deep blue, tinged with yellow, paler on the sides, and silvery on the belly. It is a fat, rich fish, and abounds in the Northern Atlantic, near the shores of both continents. Although the herring fishery in this country is of considerable importance, it does not hold the rank in our industrial and commercial affairs which it does in Europe. In a German work, I have found an article on this subject so interesting that I am tempted to introduce a synopsis of it here.

"In mile-long shoals, often so thickly pressed that a spear cast into them would stand upright in the living stream, the common herring appears annually on the coasts of North-western Europe, pouring out the horn of abundance into all the lochs, lays, coves, and fiords, from Norway to Ireland, and from Orcadia to Normandy. Sea-birds, without end, keep thinning their ranks during the whole summer; armies of rorquals, dolphins, seals, shell-fish, cods, and sharks devour them by millions, and yet, so countless are their numbers, that whole nations live upon their spoils.

"As soon as the season of their approach appears, fleets of herring boats leave the northern ports, provided with drift nets, about twelve hundred feet long. The yarn is so thick that the wetted net sinks through its own weight, and need not be held down by stones attached to the lower edge, for it has been found that the herring is more easily caught in a slack net. The upper edge is suspended from the drift rope by various smaller and shorter ropes, called *buoy ropes*, to which empty barrels are fastened; and the whole of the floating apparatus is attached by long ropes to the ship. Fishing takes place only during the night; for it is found that the fish strike the nets in much

greater numbers when it is dark than when it is light. The darkest nights, therefore, and particularly those in which the surface of the water is ruffled by a fresh breeze, are considered the most favorable. To avoid collisions, each boat is furnished with one or two torches. From off the beach at Yarmouth, where often several thousand boats are fishing at the same time, these numberless lights, passing to and fro in every direction, afford a most lively and brilliant spectacle. The meshes of the net are exactly calculated for the size of the herring—wide enough to receive the head as far as behind the gill-covers, but too narrow to allow the pectoral fins to pass. Thus the poor fish, when once entangled, is unable to move backwards or forwards, and remains sticking in the net, like a bad logician on the horns of a dilemma, until the fisherman hauls it on board. In this manner, a single net sometimes contains so vast a booty, that it requires all the authority of a Cuvier or a Valenciennes to make us believe the instances they mention. A fisherman of Dieppe caught in one night two hundred and eighty thousand herrings, and threw as many back again into the sea. Sometimes great sloops have been obliged to cut their nets, being about to sink under the superabundant weight of the fish.

"The oldest mention of the herring fishery is found in the chronicles of the Monastery of Evesham, of the year 709, while the first French documents on the subject only reach as far as the year 1030. As far back as the days of William the Conqueror, Yarmouth was renowned for its herring fishery; and Dunkirk and the Brill conducted it on a grand scale centuries before William Benkelaer, of Biervliet, near Sluys, introduced a better method of pickling herrings in small kegs, instead of salting them, as before, in loose, irregular heaps. It is very doubtful whether Solon or Lyeurgus ever were such benefactors of their respective countries as this simple, uneducated fisherman has been to his native land; for the pickled herring mainly contributed to transform a small and insignificant people into a mighty nation.

"In the year 1603, the value of the herrings exported from Holland amounted to twenty millions of florins; and in 1615, the fishery gave employment to two thousand buysens, or smacks, and to thirty-seven thousand men. Three years later we see the United Provinces cover the sea with three thousand buysens (nine thousand additional boats served for the transport of the fishes), and the whole trade gave employment at least to two hundred thousand individuals. At that time Holland provided all Europe with herrings; and it may, without exaggeration, be affirmed that this small fish was their best ally and assistant in casting off' the Spanish yoke, by providing them with money, the chief sinew of war. Had the Emperor Charles V. been able to foresee that Benkelaer's discovery would, one day, prove so detrimental to his son and successor, Philip II., he would hardly have done

the poor fisherman the honor to eat a herring and drink a glass of wine over his tomb.

" But all human propensity is subject to change ; and thus, towards the end of the sixteenth century, a series of calamities ruined the Dutch fisheries. Cromwell gave them the first blow by the Navigation Act ; Blake the second, by his victories ; in 1703 a French squadron destroyed the greatest part of their herring-smacks ; and finally, the competition of the Swedes, and the closing of their ports by the English, under the disastrous domination of Napoleon I., completed the ruin of that branch of trade which had chiefly raised the fortunes of their fathers.

" In the year 1814, when the Dutch first began to breathe, after having shaken off the yoke of the modern Attila, they made a faint attempt to renew the herring fishery with one hundred and six boats, which, up to the year 1823, had only increased to one hundred and twenty-eight ; since 1836, however, there has been a steady progress, and herring catching in the Zuyder Zee during the winter months is yearly increasing in importance.

" During the second half of the last century, while the herrings began to desert the Dutch nets, they enriched the Swedes, who, during the year 1781, exported from Gottenburg alone one hundred and thirty-six thousand six hundred and forty-nine barrels, each of them containing twelve hundred herrings. But, some years after, the shoals on the Swedish coasts began also to diminish, so that in 1799 there was hardly enough for home consumption. And now commenced the rapid rise and increase of the Scotch herring fisheries ; and it is certainly remarkable that this should have taken place at so late a period, since the British waters are, perhaps, those which most abound in herring. When we think of the present grandeur of British commerce, which furnishes the most distant parts of the globe with articles of every description, it seems almost incredible that, up to the middle of the sixteenth century, the herring fishery on the British coasts was left in the hands of the Dutch and Spaniards, and that the enterprising Scots should have been so tardy in working the rich gold mines lying at their gates. But, if their appearance in the market has been late, they have made up for lost time by completely distancing all their competitors. In 1826, the Scotch herring fisheries employed no less than ten thousand three hundred and sixty-three smacks, or boats, manned by forty-four thousand five hundred and ninety-five fishermen, who handed over the produce of their nets to at least seventy-six thousand picklers and curers ; and, in that same year, the Scotch herrings were proclaimed superior to the Dutch by the connoisseurs of Hamburg. The English herring fishery is also extremely important ; for Yarmouth alone employs in this branch of trade about four hundred sloops, of from forty to seventy tons, the largest of

which have ten or twelve men on board. Three of these sloops, belonging to the same proprietor, landed, in the year 1857, two hundred and eighty-five lasts, or three millions seven hundred and sixty-two thousand fishes; and as each last was sold for fourteen pounds sterling, it is probable that no whaler made a better business that season. The importance of the Yarmouth herring fishery may be inferred from the fact, that it gives employment and bread to about five thousand persons during several months of the year, and engages a capital of at least seven hundred thousand pounds. No wonder that, among the North seamen, the herring fishery is called the 'great' fishery, while that of the whale is denominated only the 'small.'

"But the herring is a very capricious creature, seldom remaining long in one place; and there is not a station along the British coast which is not liable to great changes in its visits, as well in regard to time as to quantity. The real causes of these irregularities are unknown; the firing of guns, the manufacture of kelp, and the paddling of steamboats have been assigned as reasons; but such reasons are quite imaginary.

"The supposed migration of herrings to and from the high northern latitudes is not founded on fact; the herring has never been seen in abundance in the northern seas, nor have our whale-fishers on Arctic voyages taken any particular notice of them. There is no fishery for them of any consequence either in Greenland or Iceland. On the southern coast of Greenland the herring is a rare fish, and, according to Crantz, only a small variety makes its appearance on the northern shore. This small variety, or species, was found by Sir John Franklin on the shore of the Polar basin, on his second journey. There can be no doubt that the herring inhabits the deep water all round the coast, and only approaches the shores for the purpose of depositing its spawn within the immediate influence of the two principal agents in vivification,—increased temperature and oxygen; and, as soon as that essential object is effected, the shoals that haunt the superficial waters disappear, but individuals are found, and many are to be caught, throughout the year. So far are they from being migratory to us from the north only, that they visit the west coast of Cork in August, arriving there much earlier than those which come down the Irish Channel, and long before their brethren make their appearance at places much farther north. Our common herring spawns towards the end of October, or the beginning of November; and it is for two or three months previous to this, when they assemble in immense numbers, that the fishing is carried on, which is of such great and national importance. 'And here,' Mr. Couch observes, 'we cannot but admire the economy of Divine Providence, by which this and several other species of fish are brought to the shores, within reach of man, at the time when they are in their highest perfection, and best fitted to

be his food.' The herring, having spawned, retires to deep water, and the fishing ends for that season. While inhabiting the depths of the ocean, its food is said, by Dr. Knox, to consist principally of minute entomostraceous animals, but it is certainly less choice in its selection when near the shore."

C. Pilchard. — This species, in size and some other respects, resembles the herring. Its range, however, is farther south. It is not common in our waters, and, so far as I know, has never been an object of pursuit by our fishermen; but to the poor people of the British and French coasts, it is of inestimable value.

The older naturalists considered the Pilchard, like the herring, as a visitor from a distant region, and they assigned to it also the same place of resort as that fish, with which, indeed, the Pilchard has been sometimes confounded. To this it will be a sufficient reply, that the Pilchards are never seen in the Northern Ocean. They frequent the French coasts, and are seen on those of Spain, but on neither in considerable numbers, or with much regularity; so that few fishes confine themselves within such narrow bounds. On the coast of Cornwall, they are found throughout all the seasons of the year, and even there their habits vary in the different months. In January they keep near the bottom, and are chiefly hauled up in the stomachs of ravenous fishes; in March they sometimes assemble in schools, but this union is only partial, and not permanent, and only becomes so in July, when they regularly and permanently congregate so as to invite the fisherman's pursuit. The season and situation for spawning, and the choice of food, are the chief reasons which influence the motions of the great bodies of these fish; and it is probable that a thorough knowledge of these particulars would explain all the variations which have been noticed in the doings of the Pilchard in the numerous unsuccessful seasons of the fishery.

They feed with voracity on small crustaceous animals, and Mr. Yarrell frequently found their stomachs crammed with thousands of a minute species of shrimp, not larger than a flea. It is probable, when they are in search of something like this, that fishermen report they have seen them lying in myriads quietly at the bottom, examining with their mouths the sand and small stones in shallow water. The abundance of this food must be enormous to satisfy such a host. "When near the coast," says the author of the *History of British Fishes*, "the assemblage of Pilchards assumes the arrangement of a mighty army, with its wings stretching parallel to the land, and the whole is composed of numberless smaller bodies, which are perpetually joining together, shifting their position, and separating again. There are three stations occupied by this great body, that have their separate influence on the success of the fishery. One is to the eastward of the Lizard, the most eastern extremity, reaching to the Bay of Bigbury in Devonshire,

beyond which no fishing is carried on, except that it occasionally extends to Dartmouth; a second station is included between the Lizard and Land's End; and the third is on the north coast of the county, the chief station being about St. Ives. The subordinate motions of the shoals are much regulated by the tide, against the current of which they are rarely known to go, and the whole will sometimes remain parallel to the coast for several weeks, at the distance of a few leagues; and then, as if by general consent, they will advance close to the shore, sometimes without being discovered till they have reached it. This usually happens when the tides are strongest, and is the period when the principal opportunity is afforded for the prosecution of the seine fishery." The quantity of Pilchards taken is sometimes incredibly large. In 1847 (a very productive year), forty thousand hogsheads were cured in Cornwall alone, representing, probably, after all deductions, a net value to the takers of eighty thousand pounds; of these, sixteen thousand were sold in Naples, and ten thousand in the ports of the Adriatic—the two principal markets. The fish are cured simply by pressure in layers strewn with bay salt.

Some investigations which we have made into the natural history and habits of the Pilchard serve to confirm our idea, that herrings of every description breed all the year round, and that there are spring, summer, autumn, and winter races of herring ever coming to maturity, as month follows month, with the greatest possible regularity. Some writers have indicated an opinion that fishes of the herring kind spawn twice a year. We do not believe that to be the case. The individuals of the herring kind that spawn in March are not the same fish that spawn again in August. They evidently belong to different varieties. Mr. Jonathan Couch, a distinguished naturalist of Polperro, is of this opinion.

The same idea prevails about this fish that used to prevail about the common herring; namely, that it is migratory, or, at least, that it roams about from place to place. An old poet says,—

" Pilchards and shads in shoals together keep;
The numerous fry disturbs the mantling deep;
No home they know, nor can confinement love,
But, fond of hourly change, unsettled rove;
Now choose the rocks, now seek the wider seas,—
No place can long the restless wanderers please."

We can only say of the Pilchard, as we have already said of the common herring, that it is not migratory in the sense meant. The fish gather together from their feeding-grounds in order to spawn; after that is accomplished, they in all probability separate, and lead an individual life, till the reproductive instinct again seizes upon them.

C. Sprattus. — This species may be considered a small herring. It is of great value to the common people of the British coasts, supplying them during all the winter months with a cheap and agreeable article of food, and the farmers with an excellent and economical manure.

C. Sardina. — The Sardine is a still smaller member of the same family, and is found in the Mediterranean, where the herring is not known. It is everywhere very much esteemed, and has become an extensive article of commerce. It makes its appearance in the spawning season in countless multitudes along the shallow coasts. It is mostly caught in the neighborhood of Antibes, Fréjus, and St. Tropez, and sent pickled in enormous quantities to the fair of Beaucaire, from whence it is transported in small tin boxes to all parts of the world.

C. Minima. — This is a very numerous species in the waters along our coasts. The individuals are from one to four inches in length. The back is nearly black; the upper part of the sides is dark green, and the lower, silvery, with roseate and golden reflections. They are pretty fishes, but are of no value.

ALOSA. — The generic characteristics are the same as those of the preceding genus, with the exception of a deep notch in the upper jaw, in the centre. There are several very valuable species.

A. Vernalis. — The Spring Herring, or Alewife. I am satisfied that this is the same fish which Le Sueur describes under the name of *Clupea fasciata*, and do not know why our ichthyologists give it a place in both genera.

The old Indian name of the fish was *Hooof*, whence, by corruption, the common designation, *Alewive*. Although the numerous iron mills and manufactories of various kinds, which have rendered our streams impure, have considerably diminished the tribe, it still is plentiful along our coasts, and, in numbers, equal to the demand. The length of the fish is about twelve inches; the back is bluish-purple; the sides light coppery, and the belly silvery. The head is small; the eyes and mouth large.

Alewives are usually cured by drying or smoking, after being salted. They are highly valued as a relish. The fresh fish, when broiled or fried, forms a delicious dish. In its dry state, it is an extremely cheap article of food, being now sold (1869) at eighteen cents per dozen. Taunton River, and all the streams that empty into Narragansett and Buzzard's Bays, produce immense numbers of them.

A. Vulgaris. — The Common Shad. This valuable and excellent tribe of fishes, although much reduced by the same causes which have restricted the salmons and alewives, is still sufficiently numerous to supply our markets. They approach the coasts in the poetic season of the year, and when the fields along the rivers and streams are glorious and fragrant with the bloom

of the orchards, they make their periodical visit to the interior. The old Shad return in August; the young at a later period.

The species is usually from one to four pounds in weight, and has been known to attain the length of three feet. In its fresh state (broiled, baked, or fried), it is an agreeable and wholesome diet. I have eaten it on the tables of fishermen, in its salted state, boiled, and found it excellent.

A. Menhaden. — The Menhaden. This fish, sometimes called the *Hard-head* and *Pauhagen*, although it has many of the characteristics of *Alosa*, in other respects comes nearer to the herring, especially by its excessively oily flesh. As a general thing, it is larger than the alewife or the English herring. From May to November it throngs our waters in countless millions, and is used as bait, and manure for land. They are strewed by cart loads over the fields, and, as they decay, become a powerful fertilizer. One Menhaden is considered equal to a shovelful of barnyard manure. This method of using them, however, is open to many objections. The decaying fish fill the surrounding atmosphere with an intolerable stench, which is productive of dysentery and other diseases. To obviate this difficulty, factories have been established to manufacture the Menhaden into a kind of guano.

"The net, with which the fish are caught, is peculiarly managed; it is about one hundred and ten fathoms in length, and provided with corks on one side, and iron rings on the other. When a school of fish is discovered, two seine boats, each bearing its portion of the seine, are started off noiselessly in opposite directions, and rapidly surround the fish. As soon as this is accomplished, the boats having formed a circle and coming together, the ends of the net are joined. The seine now encloses the fish, being kept in a vertical position by means of the cork floats. Ropes pass through these rings, and are attached to a heavy leaden weight, which is thrown overboard, and, by drawing the ropes, purses the net. The fish are thus brought near the surface, and loaded on board the 'carry-aways,' to be taken to the factory's dock. At the factory, the fish are measured either in cars or boxes, and are drawn upon the railway to the tanks, where they are thrown into water, and a full head of steam turned on into the bottom of the tank, which contains some sixteen to eighteen thousand fish. After thirty minutes' cooking, the water is drained off, and a man, getting into the tank, fills the curbs, which are circular, and formed of strong, wooden slats, bound and lined with heavy iron. These are rolled under a solid, stationary head, fitting closely the inside of the curb, and against which the fish are pressed, as the curb is slowly, but powerfully, raised by an hydraulic press. The oil and the water absorbed by the fish in boiling are pressed out through the slats, and carried by leaders to the tanks in the shed by the side of the factory, where the oil-man skims, boils, and otherwise prepares it for barrelling. As

soon as the pressure is taken off, the curb slowly resumes its position on the railway, and is pushed to where a man stands ready to remove the cheese, as it falls from the curb, upon the opening of its hinged bottom.

"This cheese, or scrap cake, is ground to different degrees of fineness to form the fish-guano; this substance, being rich in ammonia-producing material, is used by some manufacturers of fertilizers to supply ammonia to phosphates that are deficient in that constituent."

BONY FISHES. ORDER III.—MALACOPTERYGII SUB-BRACHIATIS.

The fishes of this order have the ventral fins under the throat, and the pelvis suspended to the shoulder-blade, which gives them an advantage over the Abdominal Fishes in ascending and descending.

GADIDÆ.—*First Family of Order III.*

This family of fishes far transcends all others in its importance to man. In countless millions, they range the cold and temperate seas, and, being generally gregarious, rove in vast shoals, which renders the capture of immense numbers of them a comparatively easy task. They have a body moderately long, somewhat compressed, and covered with very small, soft scales. All the fins are soft. The head is well-proportioned and naked; the jaws and front of the vomer have unequal-pointed teeth, of rather small size, disposed in rows, like a card or rasp; the gill-openings are very large, and there are seven rays. Most of them have two or three fins on the back, some behind the vent, and a distinct caudal fin. The air-bladder is large and strong. Linnaeus included them all in the great genus *Gadus*, but naturalists, since his day, have separated them into several genera, the most important of which is

MORRHUA.—The Cod. The generic characteristics are, —

Body elongated, smooth, compressed towards the tail; back furnished with three dorsal fins; ventrals pointed; abdominal line with two fins behind the vent; the lower jaw with one barbule at the chin; seven gill-rays.

M. Vulgaris.—The Common Cod. The back of this species is of a dusky hue, the sides lighter, and the belly is whitish. The whole of the upper part of the body is covered with brown and yellowish spots. I do not think the Cod admits of division into the numerous species which our naturalists have designated. The differences in appearance and quality are attributable to the nature of the ground where they feed, and other causes which might easily be specified. The Common Cod abounds in all European

seas from Ireland to Gibraltar, but appears most abundantly on the eastern side of the American Continent, and among its numerous islands from 40° up to 66° north latitude, where it may be said to hold dominion from the outer edge of the great banks of Newfoundland, which are more than three hundred miles from land, to the verge of every creek and cove of the bounding coast. To support such a mass of living beings, the ocean sends forth its periodical masses of other living beings. At one season, the Cod is accompanied by countless myriads of the Capelin (*Salmo Arcticus*), and, at another, by equal hosts of a molluscous animal, the Cuttle-fish (*Sepia loligo*), called by the fishermen, Squid. The three animals are migratory; and man, who stations himself on the shore for their combined destruction, conducts his movements according to their migrations, capturing millions upon millions of capelins and squids to serve as a bait for the capture of millions of cods. In the United Kingdom alone, this fish, in the catching, the curing, and sale, supplies employment, food, and profit to thousands of the human race; but the banks of Newfoundland are the chief scene of its destruction. As soon as spring appears, England sends forth two thousand ships, with thirty thousand men, across the Atlantic, towards those teeming shallows; France about one half the number; and the Americans as many as both together. On an average, each vessel is reckoned to catch from thirty thousand to forty thousand fishes; and we may form some idea of the voracity, as well as of the numbers, of the cod, when we hear that, in the course of a single day, a good fisherman is able to haul up four hundred, one after another, with his line, which is no easy task, considering that a single cod often attains a length of from two to three feet, and a weight of from twenty to sixty pounds. On the Grand Banks, I have frequently been obliged to pause for breath when drawing a huge specimen of forty or fifty pounds.

The waters along our coasts furnish the markets abundantly with fresh cod at all seasons of the year; but the salted and dried fish, of which there is such an immense consumption throughout the country, are caught chiefly on the Grand Banks of Newfoundland. The vessels employed by Americans in this business are strongly built sea-boats, generally of from fifty to seventy tons burthen; the French and English, for obvious reasons, employ a much larger class. I cannot, perhaps, convey a clearer idea of the method of prosecuting this valuable industry on the *Banks*, than by giving a brief description of an actual voyage thither, and of the proceedings which are usually adopted in taking and curing the cod. In 1834, I visited these celebrated fishing-grounds with Captain Philip Cook, in the Powhatan, a schooner of about sixty tons, belonging to Provincetown, Mass., and manned by a crew of nine persons. We arrived on the Banks a little

after the middle of April. These vast shoals, hundreds of miles from land, and covered with a perpetual fog, thick as night, through which the sun scarcely makes an opening more than two or three times a week, are dismal enough. Yet they are rich in thousands of objects which interest the naturalist. The bottom swarms with floral treasures of exceeding beauty, most brilliantly and delightfully tinted, rivalling the flowers which adorn the hills and valleys of the upper world, yet all are instinct with animal life.

The first operation, after the anchor is dropped, is to prepare bins or pens, if this has not previously been done, for the reception of the fish as they are hauled in. Two of these are required on each side of the vessel, near the fishermen who tend the lines. These last are attached to *cleats*, fastened to the stanchions which support the bulwarks, over which they fall into the water, and are allowed to sink until the baited hooks are within a few inches of the bottom. If the cod are hungry, and bite briskly, a few hours fishing will fill the bins, when the labor of catching ceases, and preparations are made for *dressing* them.

The crew of a fishing-vessel is divided into two *watches*, which alternately relieve each other, at intervals of two or four hours. That of the Pow-hattan consisting of eight, exclusive of the cook, each watch comprised four persons. In the dressing and salting of the fish, there is a curious division of labor, which necessitates a peculiar organization, in which each man is assigned to a particular office; as, for example, our men were thus arranged: Philip Cook and James M. Turner, *splitters*; Frederick Hunt and Thomas R. Whorf, jr., *salters*; Isaac Small and Charles Cook, *throaters*; J. F. Witherel * and A. C. L. Arnold, *headlers*. The throater takes the cod from the bin, places it upon the table temporarily erected for the purpose, and, with a sharp knife, cuts the throat and the muscles of the neck to the bone, and splits open the belly, when he shoves it along to the header, who places the fish on its back, with the neck just on the edge of the table, and then, with a sudden movement or jerk, presses the head down, which breaks the neck, and easily severs the head from the body. He then draws out the viscera, which, after separating the liver, which slips through a hole into a vessel prepared to receive it, he casts into a tub, and slides the fish down to the bottom of the table, when the splitter opens it upon the back, along the bone, the vertebrae of which he severs, as is seen in dried specimens, and flings it into the hold to the salter.

The *catch* for the time being thus disposed of, the table is unshipped, and the offal is cast into the sea, when the gulls, in numbers innumerable, commence their revels. These voracious birds, which can swallow a cod-liver as large as their own bodies, have no respect for each other's rights,

* Afterwards a distinguished clergyman of Maine.

and fight with one another, with the most desperate fury, for the possession of dainty morsels, and continue their warfare with unabated violence, until the great Black Sea-gull (Hawk of the Sea) sweeps down among them, when they scatter like spray before the tempest.

The cod on the Grand Banks sometimes exhibit peculiarities, for which, to my knowledge, no explanation is given. Schools are not unfrequently met with, lean and lank, as if they had just arrived from a great distance, without stopping to take rest or food. Others are often taken which have a considerable quantity of stones in their stomachs. In regard to this last phenomenon, the common opinion among fishermen is that these schools are about leaving the Banks, and the stones serve as a ballast to enable them more easily to descend into deep water. These fishes always dwell near the bottom, and require a comfortable degree of coldness, and, as the summer sun warms the northern seas, they naturally seek deeper and consequently cooler waters.

A trip to the Grand Banks generally occupies from ten to twelve weeks, often more, rarely less. A "full fare" having been obtained, the vessel returns to port, when the salted fish are transferred to the land, spread on "flakes," and carefully dried in the sun.

Many fishermen now take the cod on the Banks by *trawls* instead of lines. These are ropes of great length, with hooks attached along the entire extent. Properly baited, they are laid either in a straight line or semicircle on the bottom of the sea, and retained there by suitable weights. These *trawls* are visited at intervals, drawn up, commencing at one end, the fish removed, if any have been caught, the hooks re-baited, and then they are replaced for a new set of victims.

Nearly every part of the cod is of service to man. The flesh, as an article of food, maintains the first place in the economy of all civilized nations. The *head* fresh, properly cooked, is an exquisite delicacy. The liver supplies an oil valuable in pulmonary diseases, and in the arts. The gall is a powerful alkali, and softens the sea water so that the fishermen can wash their clothing in it as easily as if it were taken from the running stream. The tongues are well known to commerce, and the "sounds," besides being nutritious as food, furnish the isinglass with which cotton manufacturers size their yarn.

M. Eglefinus. — The Haddock. In his report to the Massachusetts Legislature in 1839, Dr. Storer says,—

"Immense shoals of this fish are found on our coast in the spring, and continue through the season until the autumn. Ten years since, this species was comparatively rare at Cape Cod; now, it is almost as common there as in any part of our bay. It is estimated that, in the *warm season*, about



1. THE PIKE 2. *PLATYSTOMA TIGRINUM*



1. WOLF FISH 2. PIKED DOG FISH



FLYING FISH



CROWNED STURGEON STURGEON



1. GUDGEON 2. TENCH



1. COMMON PERCH 2. THE BUTT

twelve hundred-weight of Haddock are taken to one hundred-weight of Codfish in Massachusetts Bay; and in the *winter*, about twelve hundred-weight of Cod to one hundred-weight of Haddock; but, as the Haddock fishery is of longer duration, the quantities through the year will average about the proportion of three Haddock to one Cod. Large numbers are sold in the market; and, during the entire summer, it is generally eaten by the poorer classes, who are often able to obtain a fine fish weighing several pounds for one or two cents. When taken in larger quantities than they can be disposed of in the market, they are frequently strewed over the earth for manure.

"The specimen before me is twenty-four inches in length. Length of the head, compared to the whole length of the body, exclusive of the caudal rays, as six to twenty inches; depth of the body, across from the anus, less than the length of the head. Color, above the lateral line, a dark gray; beneath this line, a beautiful silvery-gray, with a large, and in many specimens nearly a circular patch, on each side, on a line with the middle of the pectorals, its upper portion generally extending above the lateral line, its larger portion usually beneath it. Back of the head very convex; gill-covers much lighter colored than the top of the head and snout; upper jaw projects beyond the lower; teeth in the upper jaw longer than in the lower, and nearly vertical; a very minute barbule at the chin; posterior nostril much larger than the anterior. Longest diameter of the eye more than one sixth the length of the head, pupils black, irides bluish; the distance between the eyes equal to nearly one third the length of the head. The lateral line, commencing at a distance above the posterior angle of the operculum, equal to the length of the head, assumes the curve of the body until on a plane with about the middle of the second dorsal fin, from which point it runs on in a straight line to the base of the caudal rays; through its whole course, it is of a jet-black color."

Dr. Storer's description of the species is correct; but, regarding his estimate of the *quality* of the flesh, many people entertain a different opinion. I consider the Haddock as as far superior to the Cod, in its delicacy and wholesomeness, as the chicken is superior to the goose.

The Haddock figures in the old Norse mythology. When the god Thor went in pursuit of Luke to bring him to justice, for encompassing the death of Balder the Beautiful, that evil spirit transformed himself into the form, or concealed himself in the body, of a Haddock, and sought refuge in the abysses of the ocean. The god pursued him to his retreat, marching over the oceanic mountains, "as if they were rocks of little size," and seized the offender by the nape; but the cunning and treacherous demon wriggled through his fingers, and escaped. The black lateral line, which adorns the

fish from the head to the caudal rays, was believed by the Norsemen to be the finger-marks of the god.

M. Tomcodus. — The Tomcod. This favorite species is found in all the streams, ponds, and creeks of this country. Angling for this fish is a prime amusement with our youth in winter, when it is taken with the hook through holes in the ice. At other times, it is caught with scoop-nets. It is about a foot long, of very variable colors, generally brown, yellowish-brown, greenish, with darker splashes and spots; lighter on the belly.

MERLANGUS. — The generic characteristics are the same as those of the *Morrhua*, with the exception of the cirri.

M. Merlangus. — The Whiting. This species is about a foot in length, of a pale reddish-gray above, and silvery below. Its flesh is light and wholesome.

M. Carbonarius. — The Coal-fish. This fish is two or three times the size of the Whiting. Its color is blackish-brown above; below the lateral line, which is straight, the body is of a bluish-white; the belly lighter than the sides. The flesh of the full-grown Coal-fish is coarse and tough, but will take salt, like the cod.

M. Polachius. — The Pollock. The Pollock, in its dried state, is a well-known fish, and is esteemed by many above the cod. Its color is greenish-brown above, lighter on the sides, and white on the belly. The sides are often spotted. It is about two feet in length.

MERLUCIUS. — This genus is characterized by a flattened head, an elongated body, two dorsal fins, the first short, the second long; and one anal fin, also very long.

M. Vulgaris. — The Hake. This fish is quite as well known as the Pollock. It abounds in all parts of the Atlantic. It has no barbule, and the first dorsal fin is pointed. It sometimes exceeds two feet in length, and is of a brownish-gray color. It is captured in considerable quantities, and is cured like the cod, but the flesh is coarse.

LOTA. — The Ling, i. e., Long-fish, has two dorsals, one anal fin, and cirri at the mouth. *L. mola* attains a length of from three to four feet, and is said to be not inferior to the cod. The dorsals are equally high, the lower jaw is a little shorter than the upper, and adorned with a cirrus. The color is olive above, and silvery beneath.

L. Lota. — The Burbot is from one to two feet long, has the dorsals of equal height, and one cirrus. The head is considerably depressed, and the body is cylindrical, of a yellow color, mottled with brown. This species ascends rivers, and its flesh is highly valued.

L. Compressa (Eel Pout). — This small specimen was found in the Connecticut River, and differs from the Burbot in nothing but size, being but six inches in length.

BROSNIUS. — An elongated body, one dorsal, extending the whole length of the back, fleshy ventral fins, and one barbule at the chin, are the distinguishing marks of the genus.

B. Vulgaris. — The Cusk. This species is common in the Atlantic, and is about two feet in length. Color of the body an uniform dark slate; head rather darker than the body. Head one fifth the length of the body; width of the body, across the commencement of the anal fin, exclusive of the dorsal fin, equal to one sixth the length of the specimen; width of the head, across the posterior angle of the operculum, equal to two thirds its length; the scales on the head present a peculiarly corrugated appearance. Mouth large. Jaws filled with sharp, recurved teeth. Upper jaw slightly longer than the lower. A single barbule under the chin. In the spring of the year it is not unfrequently met with in the Boston market, and does not sell as readily as the cod; in the winter season it is rare, and then sells readily for double the prices of that species. By many, as a fresh fish, it is considered quite a delicacy, and when salted, is thought preferable to the cod.

The liver of this species contains a large quantity of oil, which is sometimes preserved by the fishermen, who consider it an excellent application to a burned surface.

PHYCIS. — This genus has a single ray in each ventral, which is produced and forked; two dorsal fins, the first shorter than the second; and one barbule on the chin.

P. Americanus. — The Codling, or American Hake. This species often attains a length of three feet. The upper part of the body is grayish-brown, the belly lighter. They are taken chiefly at night, with the hook. The fishermen call it (erroneously) the "Old England Hake." It abounds in the vicinity of Cape Ann. I have found it served up on the tables of the Pavilion House, at Gloucester, and of the Pigeon Cove House, Rockport, Mass., and can testify to its excellence. Corned and broiled, it is a popular item in the breakfast bill of fare.

PLEURONECTIDÆ. Second Family of the Malacopterygii sub-brachiata.

"These are all included in the great genus *Pleuronectes*, which have a character quite unique among vertebrated animals; this consists in the want of symmetry in the head. An animal is said to be symmetrical when it is supposed to be divided in a mesial plane, or plane exactly along the middle, in a vertical direction,—the two sides being the exact counterparts of each other, and differing in nothing but in the one being turned to the right, and the other to the left. These fishes have both eyes on one side, and this side

always remains uppermost when the animal is swimming, while all other fishes swim on the belly. The upper side is, in general, deeply colored, while the other side is whitish. The body, from the head backwards, though formed nearly as usual, partakes a little of this peculiarity. The two sides of the mouth are not equal, and the pectoral fins are rarely so; the body is depressed, and elevated in the direction of the spinous processes; the dorsal extends along the whole back; the anal occupies the lower edge of the body, and the ventrals are sometimes united with it. The fins are thus lateral fins, in respect of the swimming of the fish when in motion; and the action of the spine is vertical, in respect of that position, and not lateral, as in other fishes. They have six gill-rays; the abdominal cavity is small, but extends in a cavity embedded in the flesh on the two sides of the tail, for the purpose of containing some of the viscera; they have no air-bladder, and they seldom rise far from the bottom. Notwithstanding the peculiarity of the cranium, by that twist of the neck which brings both eyes to one side, the bones are the same as in other families, but very differently proportioned. They are found along the shores of almost all countries, and are, generally speaking, wholesome and agreeable eating.

"Some individuals have the eyes placed in the opposite side to that in which they are generally found in their species, and these are said to be reversed. Others have both sides colored alike, in which case they are called 'Doubles.' It is usually the colored side which is doubled, though occasionally it is the white one."

P. Platessa.—The Plaice. These fishes have a row of sharp teeth in each jaw, and very often pavement teeth in the pharynx; the dorsal does not advance more forwards than the upper eye, and both it and the anal terminate and leave smooth spaces before the base of the caudal; they generally have two or three small cœca, and six gill-rays. *P. vulgaris* (common Plaice) has six or seven tubercles, forming a line between the eyes, and spots of aurora red over the brown on the upper side of the body. The height is but a third of the length; and the flesh is soft, and soon decomposes. *P. flesus*, the Flounder, similar, but with the spots lighter; some tubercles on the head, and some on the base of the dorsal and anal fins, and have rough scales on the lateral line. They ascend a considerable way up rivers, and reversed individuals are not unfrequently caught. *P. limanda*, the Dab, has the eyes large, the lateral line curved above the pectoral, the scales rough, and the upper side brown, with whitish spots. *P. microcephalus*, the Laminder, with the eyes smaller, nearer each other, and the back finely mottled with brown and yellow. Both these are found in the salt water, as is also *P. leminoides*, the Long or Rough Dab, which has the body elongated, something like a saw, and it approaches that species in

quality. *P. polu*, the Crayed Fluke, has the head small, the right eye considerably in advance of the left, with the body yellowish-brown, and the fins darker. All these, and some other species, are found on our shores, chiefly on muddy or sandy bottoms.

HIPPOGLOSSUS. — Shape and fins like a Flounder; lateral line arched. The chief representative of the group is

H. Vulgaris. — The Halibut. Dr. Storer says, "This well-known and excellent fish is taken in shoal water, in large quantities, during the summer months; at other seasons, it inhabits deeper waters. Great numbers are taken upon Nantucket Shoals, frequently weighing two hundred pounds each. The flesh of this species is rather coarse and dry, but is much esteemed by many; the fins are considered quite a delicacy. Fresh, this fish brings a higher price than the cod; large quantities also are smoked; and, occasionally, the dried flesh is eaten. Some years ago a Halibut was taken upon the South Shore, and brought to Boston market, which, after the head and bowels were removed, weighed four hundred and twenty pounds; this specimen, when perfect, undoubtedly weighed as much as five hundred weight. The largest individual of which I have any certain knowledge, Mr. Anthony Holbrook, a fishmonger in Quincy Market, a man of unquestionable veracity, and whose knowledge of our fishes is equal to that of any of our fishermen, tells me was taken at New Ledge, sixty miles south-east of Portland, Me., in 1807; it weighed upwards of six hundred pounds. The voracity of this species is proverbial. Pennant cites two examples of ships' sounding-leads having been swallowed by them; one of these individuals was afterwards captured."

A large fleet is fitted out every winter at Gloucester, Mass., for the capture of this fish, which has became a favorite in the market.

RHOMBUS. — The Turbot Genus. Teeth as in the Halibut, but the dorsal advances in front of the eyes, and the anal comes to the edge of the jaws. The eyes are generally on the left, and in some they are separated by a low crest.

R. Maximus. — The Turbot is the most esteemed of the family. Its height is nearly equal to its length, its form a truncated rhombus, and with the lateral line much arched. The upper or left side is brown, and beset with tubercles; but reversed specimens are sometimes taken. *R. vulgaris* (Brill) is rounded on the sides, has the body without tubercles, and the first rays of the dorsal split into filaments. The eyes are usually on the left side. It is not so much esteemed as Turbot, still it is a good fish.

R. Aquosus. — The Watery Flounder. This fish is known among us as the Turbot. It is frequently taken, when fishing for mackerel, quite near the shore. Its average length is about eighteen inches, and specimens

weighing twenty pounds are not unfrequent. Body elongated, with small scales, perfectly smooth. Left side of a reddish-gray color, with large, circular, oval, or oblong blotches of a darker color, surrounded with a lighter margin, and also numerous white spots, which are more obvious upon the fins. Right side white, without spots. Upper eye slightly back of the under, in a vertical line. Eyes moderate in size, oblong; pupils blue-black; irides silvery; distance between the eyes equal to the longest diameter of the eye. Orbita, space in front of the eyes, jaws, spotted with dull bluish spots. Gape of the mouth large; jaws equal in length, and armed with a single row of separated, quite large, sharp teeth; the front ones much the largest. A protuberance at the chin. Nostrils three lines in front of the eyes. Gill-covers extend back of the eyes, nearly two and a half inches.

The lateral line makes a high arch over the pectorals previous to assuming its straight course to the tail; the top of this arch is more than one inch above the straight line.

Achirus. — In this group of the *Pleuronectidae* both eyes and color are on the right side; the mouth distorted on the side opposite the eyes; small teeth in both jaws, but confined to the under side only; form of the body oblong; dorsal and anal fins extend to the tail; there are no pectorals.

A. Mollis. — The Sole. This species is called the New York Sole, and is found in the waters in the vicinity of that city. It is considered a nutritious and wholesome fish, and in color and size does not differ from the *S. vulgaris* (common Sole of Cuvier), being from six to eight inches in length, and of a dark-brown color, and white beneath.

DISCOBOLI. *Third Family of Malacoptygii Sub-brachiati.*

The two principal genera are the following, both of which are found in American waters:—

LUMpus. — The head and body are thick and short; the back has an elevated ridge; the pectoral fins unite under the throat, and, with the ventrals, form a single disk.

L. Vulgaris. — The Lump-Sucker. This fish is remarkable for the affection, so unusual in fishes, which it manifests towards its progeny. The male keeps watch over the deposited ova, and guards them from every foe with the utmost courage. If driven from the spot by man, he does not go far, but is continually looking back, and in a short time returns. Thus we are constantly finding among the inferior animals glimpses of a higher nature, which prove that all created beings form a continuous chain, linked together by one all-pervading and all-mighty Power.

The sucking organ, by which it adheres to foreign substances, is on the top of the head, and consists of several plates.

Dr. Storer says the species is frequently seen in Massachusetts Bay, washed up on our beaches after a severe storm. "Occasionally, it is taken in fishing for cod, with the hook; generally, however, it is found attached to sea-weed and other floating substances near the shore. Richardson tells us that 'the Greenlanders eat its flesh, either cooked or dried, and its skin raw, throwing away only the tubercles;' and Dr. Neal observes 'that it is purchased at Edinburgh for the table.' With us, however, it is not used as an article of food. The common weight of this fish is from three to four pounds, and six to twelve pounds. The whole appearance of this fish is very forbidding, being, in young specimens, a soft, gelatinous, tremulous mass; in older specimens, it is much firmer; but in both, is covered entirely with firm, horny spines. My description is taken from a specimen seventeen inches in length.

"Length of the specimen, exclusive of the tail, fourteen inches; color of all the upper part of the body a bluish-slate; beneath, yellowish. The whole surface of the fish is covered with an immense number of small stellated tubercles, studding even the rays of all the fins. Three rows of tubercles, much larger than those which are universally distributed over the fish, are observed projecting from either side."

Echeneis.—This genus has the body elongated, covered with very small scales; a single dorsal fin placed opposite the anal; the head flat, covered with an oval disk, formed by numerous transverse, cartilaginous plates, the edges of which are directed backwards.

E. Naucrates.—The Indian Remora. This curious fish, which is about twenty inches in length, has a propensity for attaching itself, by the adhesive organ on the top of its head, to whatever object with which it comes in contact, and therefore has the rare distinction of being employed by man as a hunting-fish. When Columbus first discovered the West Indies, the inhabitants of the coasts of Cuba and Jamaica made use of the Remora to catch turtles, by attaching to its tail a strong cord of palm-fibres, which served to drag it out of the water along with its prey. By this means they were able to raise turtles weighing several hundred pounds from the bottom; "for the sucking-fish," says Columbus, "will rather suffer itself to be cut to pieces than let go its hold." In Africa, on the Mozambique coast, a similar method of catching turtles is practised to the present day. Thus a knowledge of the habits of animals, and similar necessities, have given rise to the same hunting artifices among nations that never had the least communication with each other. Everybody knows the fables that have been related of the small Mediterranean Remora (*Echeneis Remora*). It even owes its Latin name to the marvellous story of its being able to arrest a ship under full sail in the midst of the ocean; and from this imaginary physical

power a no less astonishing moral influence was inferred, for the ancients believed that tasting the Remora completely subdued the passion of love, and that if a delinquent, wishing to gain time, succeeded in making his judge eat some of its flesh, he was sure of a long delay before the verdict was pronounced.

BONY FISHIES. ORDER IV. MALACOPTERYGII APODA.

The fishes of this order compose but one family, — the *Muraenidae*, — which are lengthened in form, have the skin thick and soft, the scales almost imperecible, and but few bones. There are numerous genera.

MURENA. — This well-known genus, which contains our common Eels, has a long, slender, cylindrical body, scales nearly invisible, no ventral fins, and the vent far backwards.

M. Vulgaris. — *M. Bostoniensis* (Le Sueur). — The Common Eel. The common Eel is most frequently found in rivers and lakes, but also inhabits salt water, and is sometimes taken on our shores in incredible numbers. Its ordinary size is from two to three feet, though it has been known to attain the length of six feet, and to weigh fifteen pounds. Though impatient of heat and cold, the Eel can live longer out of the water than any other fish, and not rarely creeps upon the meadows and humid fields to catch snails or worms — a faculty for which it is indebted to the small opening of its gill-covers. It is abundant in all our rivers and ponds, and is much prized as an article of food. Its color is a grayish-brown above, and yellowish-white beneath, with a reddish tinge about the tail. In the winter, it is speared through holes in the ice; at other seasons, it is taken in nets.

M. Argentea. — The Silver Eel. This fish differs from the former chiefly in color, which is silvery-gray, darker upon its upper portion, with a clear satiny-white abdomen. "It is taken in pots in October, when it leaves the ponds, and seldom at any other time."

M. Helena. — This Eel is common in the Mediterranean, and was celebrated among the ancients, who carefully fed it in ponds. The color is mottled-brown and yellow, and length from three to four feet. These fishes have a very ferocious temper, and are extremely voracious. Vædius Pollio amused himself and his friends by casting his offending slaves into the ponds where these *Muraenæ* were kept, and witnessing their destruction by these slimy monsters.

AMMODYTES. — Head and body as in the former, but the gill-openings are large, and the dorsal fin extends nearly the whole length of the back.

This genus comprises *A. tobianus*, the Sand Eel, and *A. lancea*, the Sand Lance, species which burrow in the sand, and are supposed to constitute, in part, the food of salmon.

GYMNOTUS. — The gills of this genus are partially covered by membranes, but opening before the pectorals; vent far forward; anal fin occupying the under line of the body. It has no dorsal. The true Electric Eels have no caudal or dorsal fin, nor visible scales; moderate intestines, with several flexures, and numerous cœca; stomach short, and plaited on its inner surface. One long air-bladder extends in a cavity of the abdomen; the other, in two lobes, is placed over the gullet. Found only in the rivers and stagnant fresh waters of tropical America.

G. Electricus. — The Electric Gymnotus, called from its form the Electrical Eel. It attains the length of five or six feet, and communicates shocks so powerful that men and horses have been stunned by them. This power is voluntary, and can be sent in a particular direction, and even through the water, the fish in which are killed, or stunned, by its shocks. By giving these, it is greatly exhausted, and requires both rest and nourishment before it can renew them. The immediate organ of this power extends along the whole under side of the tail, occupying about half its thickness. It consists of two large longitudinal fasciculi above, and two smaller ones below, resting on the base of the anal fin. Each fasciculus is composed of numerous parallel membranes, nearly horizontal, and close to each other, one end being attached to the skin, and the other to the mesial plane. They are joined by numerous transverse and vertical membranes; and the canals and cells thus formed are filled with gelatinous matter. The whole apparatus is largely supplied with nerves, affording one striking instance of the intimate connection between electric or galvanic action in matter, and nervous action in animals.

BONY FISHES. ORDER V. LOPHOBRANCHII.

The name of this order (*Lophobranchii*) signifies fishes with their gills in tufts. "All the fishes of the preceding four orders not only have a skeleton of fibrous bones, and the jaws complete and free, but their gills are always in fibres or fringes, like the teeth of a comb; but those of the present order, while they have the jaws complete and free, have the gills not in equal laminæ along the arches, but in small round tufts, disposed along the arches in pairs — a structure of which there is no instance in other fishes. These are defended by a large operculum, attached by membranes on all sides, except one small hole for allowing the water to escape; and mere

vestiges of rays are shown in the substance of the operculum. These fishes are also distinguished by shields, or small plates, which cover the body, and often give it an angular form."

There are two genera:—

SYNGNATHUS. — The Pipe-fishes. They have the tubular snout of the *Fistularide*. The gill-opening is near the nape, and there are no ventral fins. They have a striking analogy to the Marsupials, in the Class Mammalia, in having a pouch under the belly in some, and at the base of the tail in others. The eggs slide into this pouch, which is formed by inflation of the skin, and remain there till they are hatched. There are several species, of which *S. fuscus*, the Brown Pipe-fish, and *S. Peckianus*, Peck's Pipe-fish, are found in our waters. *S. acus*, the Great Pipe-fish, and *S. ophidian*, the Snake Pipe-fish, and some others, are foreign. These all have the pouch under the belly. In these fishes, the order of Nature, in regard to reproduction, seems to be reversed; for it is the male, and not the female, which has the pouch, and hatches the eggs.

HIPPOCAMPUS. — The jaws of this group are like those of the preceding; mouth placed at the end; the margins of the scales are formed into ridges, and the angles into spines. There is no fin in the tail, but that organ is *prehensile*, and enables the fish to climb or hold on by the stalks of marine plants.

II. *Brevirostris*. — The Short-nosed Sea-horse is sometimes found on our shores. It is about five inches long, and of a yellowish-brown color.

BONY FISHES. ORDER VI. PLECTOGNATHII.

This order is composed of those fishes which have the maxillary soldered to the side of the intermaxillary, which constitutes the jaw, and the palatal arch connected with the cranium by an immovable suture. The differences in the character of their teeth divide them naturally into two families.

The First Family comprises the *Gymnodontes*, i. e., fishes with naked teeth. They have the jaws covered with a substance like ivory, laminated internally, and resembling the beak of a parrot. This structure is really composed of teeth united, which are reproduced as soon as they are destroyed by using. They live on crustacea and sea-weed, and their flesh is mucous and inedible.

TETRAODON. — Each jaw is marked with a suture, so as to give the appearance of four teeth, and the spines are small and low.

T. *Turgidus*. — The Swell-fish. This singular fish, which is common in Buzzard's Bay and the Vineyard Sound, has the faculty of blowing itself

up like a balloon, by filling with air a thin, membranous sac, which adheres to the peritoneum, the whole length of the abdomen. When thus inflated, it rolls over, and floats with belly uppermost. The length of this species is about nine inches. The color on the upper part of the body is yellowish-white, with innumerable minute black spots. The abdomen is white.

ORTIAGORISCUS. — The Sun-fish has the body compressed, spineless, and incapable of inflation.

O. Mola. — The Short Sun-fish. This is rather a rare fish in our waters. Dr. Storer gives the following description of one harpooned in Boston Bay : —

"The body is oval; its whole surface a fine, unyielding, granulated cuticle, covered with a thick, adhesive mucous; back dark gray. Abdomen nearly white; the right side of the body rather darker than the left; both sides of a dirty-white color, with silvery reflections. Length, fifty-four inches; depth across, from the middle of the pectorals, two and a half feet; from the top of the dorsal to the extremity of the anal fin, six and a half feet. Weight, about two hundred pounds. Length of the head, from the tip of the snout to the base of the pectoral fin, seventeen inches; flattened over the snout, which is obtuse, and projecting about an inch in front of the upper jaw. Eyes rather large, convex, very movable in their orbits; pupils black; irides a dark brown, encircled within by a silvery ring. Nostrils double, just in front of the eyes. Mouth small. Jaws armed with a broad, bony plate, sharp at the edges. Upon the top of the head, an arched ridge commences on a line with the anterior angle of the eyes, and is continued to a line above the origin of the pectorals, then a straight line is continued to the dorsal fin. The sides of the head project out from the body quite prominently over the eyes to the branchial aperture. Operculum directly in front of the pectorals, three inches in its greatest diameter. Its motions are very sluggish, and it swims near the surface of the ocean. On account of the great elasticity of its flesh, it is captured with great difficulty; it is generally gaffed at or near the branchial aperture. Its flesh is sometimes used for balls. Its liver is very oily, furnishing two or more quarts of oil, which is used by the fishermen to grease their masts with, and it is also by many of them considered a valuable application in cases of sprains and bruises."

The Second Family of the *Plectognathi* (*Sclerodermi*) is composed of fishes with hard and granulated skins. They have a conical muzzle, which is prolonged forwards from the eyes, and terminates in the mouth, with distinct teeth in both jaws. The skin is either rough or covered with very hard scales. Some of the species abound in the warm seas, near rocks, or on the

surface of the water; and their brilliant colors sparkle in the waves like those of the *Chetodons*.

The genera found on our shores are *Monocanthus*, the File-fish; *Aluterus*, the Unicorn File-fish; and *Ostracion*, the Trunk-fish. They are all small fishes, of singular appearance, but of no value to man.

CHONDROPTERYGII. (Second Series of Fishes.)

This series comprises the Cartilaginous Fishes, that is, those whose skeleton has no bony fibres, but the calcareous matter disposed in grains. The cranium is always formed of a single piece, without sutures. The *Chondropterygii* divide into two orders—those with free gills, like all other fishes, and those with fixed gills, which are so attached to the skin by the internal edges that the water cannot escape from their intervals except by holes in their surface.

ORDER I. CHONDROPTERYGII LIBERIS. (Free Gills.)

This order is composed of those fishes which "have in their gills a single wide opening, and a gill-lid, like the Bony Fishes, but they have no gill-rays. There are two genera:—

"*Accipenser*.—The Sturgeon. General form like that of the Shark, but the body more or less covered with bony plates in longitudinal rows, and the head externally armed with the same. Their mouth, placed under the muzzle, is small and toothless; and the palatal bones, soldered to the maxillaries, form the upper jaw, while there are vestiges of the intermaxillaries in the thick lips. Placed upon a pedicle of three articulations, this mouth is more protractile than that of the Shark; the eyes and nostrils are on the sides of the head, and barbules are suspended from the muzzle; the labyrinth within the cranial bones is perfect, but there is no external ear, the hole behind the temple leading merely to the gills. The dorsal is behind the ventrals, and has the anal directly opposite to it; the caudal surrounds the extremity of the spine, and terminates in the upper lobe of the tail, but an under lobe gives the tail the appearance of being forked. Internally, we find the spiral intestinal valve, and the single pancreas of the Shark family; and there is a very large air-bladder, which communicates with the gullet by a large opening. Sturgeons ascend some rivers in vast numbers, and are the object of valuable fisheries. The flesh of most is agreeable."

A. Oxyrinchus.—The Sharp-Nosed Sturgeon. This is the name applied

by Dr. Mitchell to an American species, a little over two feet in length. As this eminent naturalist says that the Sturgeon "grows seldom to a greater length than five feet," I conclude that he was not acquainted with all of our species. I have seen specimens in eastern rivers at least ten feet long, sporting, like the whales, in the exercise of breaching, shooting out of the water, and falling upon the side with a noise that could be heard at a great distance.

A. Sturio. — The Common Sturgeon has a pointed muzzle, and five rows of plates, with strong spines. It abounds in the Northern seas of Europe, where extensive fisheries are established for its destruction. Caviar is made of the roe of the female, isinglass from the membrane forming the air-bladder; and the flesh, besides being preserved by salting and pickling, is in request for the table while fresh, being generally stewed with rich gravy, and the flavor considered to be like that of veal. It is, however, far from enjoying the same repute as with the Romans, among whom it was brought to table with much pomp, ornamented with flowers, the slaves who carried it being also ornamented with garlands, and accompanied by music.

Some species attain a length of eighteen feet, and a weight of five hundred pounds. The body is elongated from the shoulders backward, somewhat pentagonal in shape, with five longitudinal rows of flattened plates, with pointed central spines directed backwards. The skin makes a good covering for carriages.

The smallest, but most delicate, of the sturgeons is the Sterlit of the Volga, which sometimes fetches such extravagant prices, that Prince Potemkin has been known to pay three hundred roubles for a single tureen of Sterlit soup.

A. Huso. — The Great Sturgeon, has blunter plates, a smoother skin, and shorter snout and cirri than the common Sturgeon. It is frequently found more than twelve, or even fifteen, feet in length, and weighing more than twelve hundred pounds. One specimen is mentioned which weighed near three thousand pounds. Its flesh is not much esteemed, and it is sometimes unwholesome; but its air-bladder yields the very finest isinglass. It is found in the Po as well as in the northern rivers.

CHIMERA. — This second genus of Cartilaginous Fishes, with free gills, closely resembles the sharks in form, and in the disposition of the fins; but the gills open externally by one apparent hole in each side, though, if we examine more closely, we find great part of their edges attached, and that there are five separate holes terminating in the common aperture; still they have a vestige of an operculum concealed in the skin. Their jaws are more reduced than in the sharks, for the palatals and temporals are mere simple vestiges suspended to the sides of the muzzle, and the upper jaw is repre-

sented by the vomer only; hard and undivided plates supply the place of teeth, four of them above, and two below.

This genus is not, to my knowledge, represented in American waters.

C. Monstrosa, sometimes called the King of the Herrings, inhabits the Northern seas of Europe. It is three feet long, and of a silvery-color, spotted with brown.

ORDER II. CHONDROPTERYGII FIXIS. (Fixed gills.)

This order is separated into two families,—*Seluchi*, the Sharks and Rays; and *Cyclostomata* (fishes with the mouth formed into a sucker), the Lampreys.

CARCHARIUS.—The Sharks. The members of this noted tribe have trenchant, pointed teeth, usually serrated in the margins; the first dorsal before the ventrals; the second nearly opposite the anals. They have no spiracles; the nostrils are in the middle of the snout, and the last gill-opening extends over the pectorals.

C. Vulgaris.—The White Shark. This much-dreaded species is sometimes twenty feet long; mouth, isosceles triangular, ragged at the sides. It is found in most seas, and its prodigious strength may be judged of from the fact that a young shark, only six feet in length, is able to break a man's leg by a stroke of its tail.

Thus, when a shark is caught with a baited hook at sea, and drawn upon deck, the sailors' first act is to chop off its tail, to prevent the mischief otherwise to be apprehended from its enormous strength. An anecdote related by Hughes, the well-known and esteemed author of the "Natural History of Barbadoes," gives a good idea of the savage nature of this monster. "In the reign of Queen Anne, a merchant ship arrived at that island from England; some of the crew, ignorant of the danger of the recreation, were bathing in the sea, when a large shark appeared, and swam directly towards them; being warned of their danger, however, they all hurried on board, where they arrived safe, except one poor fellow, who was bit in two by the shark, almost within reach of the oars. A comrade and intimate friend of the unfortunate victim, when he observed the severed trunk of his companion, vowed his revenge. The voracious monster was seen traversing the bloody surface of the waves in search of the remainder of his prey, when the brave youth plunged into the water. He held in his hand a long, sharp-pointed knife; and the rapacious animal pushed furiously towards him. It had turned on its side, and opened its enormous jaws, when the youth, diving dexterously, seized the shark with his left hand, somewhere below

the upper fins, and stabbed it repeatedly in the belly. The animal, enraged with pain, and streaming with blood, attempted in vain to disengage itself. The crews of the surrounding vessels saw that the combat was decided; but they were ignorant which was slain, till the shark, exhausted by loss of blood, was seen nearer the shore, and along with it his gallant conqueror, who, flushed with victory, redoubled his efforts, and, with the aid of an ebbing tide, dragged it to the beach. Finally, he ripped open the stomach of the fish, and buried the severed half of his friend's body with the trunk in the same grave."

It is no uncommon thing for the negroes, who are admirable divers, thus to attack and vanquish the dreaded shark; but success can only be achieved by consummate dexterity, and by those who are armed for this express purpose.

Ordinary swimmers are constantly falling a prey to the sharks of warm climates. Thus Sir Brooke Watson, when in the West Indies, as a youth, was swimming at a little distance from a ship, when he saw a shark making towards him. Struck with terror at its approach, he immediately cried out for assistance. A rope was instantly thrown, but, even while the men were in the act of drawing him up the ship's side, the monster darted after him, and, at a single snap, took off his leg.

C. Glauces.—The Blue Shark. This species has curved-sided teeth above, inclining outwards, and straighter ones below, all ragged on the edges. It does not appear to frequent American waters, but is particularly mischievous on the coasts of Great Britain. It does not attempt the fisherman's life, but is extremely troublesome and injurious to him, by hovering about his boat, and cutting the hooks from the lines in rapid succession. This, indeed, often leads to its own destruction; but when their teeth do not deliver them from their difficulty, the Blue Sharks, which hover about the Cornish coast during the pilchard season, have a singular method of proceeding, which is by rolling the body round so as to twine the line about them throughout its whole length; and sometimes this is done in such a complicated manner, that Mr. Yarrell has known a fisherman give up an attempt to unroll it as a hopeless task. To the pilchard drift-net this shark is a still more dangerous enemy, and it is common for it to pass in succession along the whole length of the net, cutting out, as with shears, the fish and the net that holds them, and swallowing both together.

C. Vulpes.—The Thresher, or Fox Shark. This is a powerful fish, with a most savage temper. It has triangular teeth in both jaws, and is remarkable for the extraordinary length of the upper lobe of the tail, which equals that of the whole body. It attains a length of twelve feet or more, and a weight of two hundred pounds. It derives its name from the power-

ful blows it deals with its tail when attacked. It often visits our waters, and feeds on mackerel and menhaden.

LAMNA. — This genus has the point of the nose conical, the nostrils pierced on its under surface, and the five gill-openings before the pectorals.

L. Punctata. — The Mackerel Shark. This is the most common shark of the Atlantic, and abounds on the American coasts, where it exercises its mischievous propensities among the lines of the fishermen, often biting them off, and thus robbing them of their prey. Its length is from six to ten feet, and its weight from three to four hundred pounds. Like the other sharks, it appears to have little sensibility, and is very tenacious of life; I have seen one of these fishes eat its own liver, which protruded through a wound made by a harpoon.

SPINAX. — Two dorsal fins, with a strong spine at the anterior edge of each; absence of the anal fin; teeth in several rows, small and cutting, distinguish this genus.

S. Anthias. — The Dog-fish. This is a common species well known to our fishermen, and resembles the shark, both in appearance and in its savage temper. The English call it the *Piked Dog-fish*, from the spines of the dorsal fins. The length is from two to three feet; the body is slender. Dr. Storer furnishes the following description: —

" All the upper part of the body of a slate-color, which is deeper upon the head; lighter below the lateral line; beneath, white; just under the lateral line, a row of circular white spots; a few similar spots irregularly distributed upon the back. Length of the head to the whole length of the fish, nearly as four to nine; the head flattened above, tapering to a blunted snout. Eyes horizontally elongated; their longest diameter nearly equal to one fourth the length of the head; pupils small, black; irides silvery, with a cupreous tint. Orbit large, allowing great motion to the eye. The distance between the eyes equal to more than half the length of the head. Between the eyes, two longitudinal patches of numerous mucous glands, which are indistinctly continued nearly to the extremity of the snout. Temporal orifices back of the eye, and just above the line of the eye; their length is equal to the short diameter of the eye. All the lower portion of the head, in front of the mouth, sprinkled over with mucous orifices.

" In the spring and autumn, the Dog-fish appear in shoals in our bay; they are frequently met with in immense numbers. At their appearance, smacks are fitted out at Truro and Provincetown for their capture, to the neglect of other fishing, for the oil they furnish; and it is said to be quite a valuable business. The fishes themselves are dried for food for the cattle, and their skin is considerably used for polishing by the mechanic. They average about eight or ten pounds weight; sometimes they weigh fifteen

pounds. They are readily caught with the hook. These shoals seldom remain in shallow water, or near the shore, more than three or four days; they feed upon the offal and garbage thrown upon the bottoms by the fishermen, and so perfectly do they clean the ground, that it is observed by old fishermen, that when the spring shoal of Dog-fish has been unusually large, the cod-fish are found in much larger numbers upon the same localities afterwards. In Scotland, the flesh of this fish is much eaten by the lower classes, and the refuse portions afford a valuable manure."

ZYGLENA.—In this genus is found that singular-looking fish, the *Hammer-headed Shark*. The snout of this fish is singularly produced, forming two pieces, like a double-headed hammer, with an eye in the middle of each extremity. Some of the species attain a very large size.

NOTIDAMUS.—In this genus are found the largest specimens of the Shark family. They have six gill-openings, triangular teeth above, and like a saw below. Some species, among them the *Squulus maximus*, are between thirty and forty feet in length. They are harmless fishes.

A remarkable specimen was exhibited in Boston in 1868, under the sensational name of Sea Serpent. It was thirty feet long, and had all the characteristics of a shark, but in addition a pair of legs, which appeared to grow forward from the base of the ventral fins. Those who had it in charge asserted that it made frequent excursions upon the land, and was shot in a meadow between two ponds. I was not, however, able to extract from them anything reliable, and have found it utterly impracticable to obtain an authentic history of this really curious animal.

PRISTIS.—The Saw-fishes. They have a long body, like the sharks, with the gill-openings below; the snout extended like the blade of a sword, and with strong, trenchant teeth on both edges, which give it the appearance of a saw, whence the popular name of the fish. This singular weapon is probably a provision of nature for the defence of the animal against the attacks of more powerful foes. I am obliged to destroy another "romance of the sea" in which the Saw-fish figures as engaging in frightful duels with the gigantic *Mysticetus*, or uniting with the Sword-fish and Grampus in making war on that mighty denizen of the ocean; the Saw-fish is a shore fish, and does not frequent the deep waters which the larger whales inhabit, and we must, therefore, consider such battles as inventions of the novel writers.

RAYA.—The Rays. These singularly unsightly fishes resemble the side-swimmers by the flatness of their form, but differ widely from them in many other particulars. Like the sharks and sturgeons, they are cartilaginous fishes, and as their branchiae adhere to the cells, these respiratory membranes are not furnished with gill-covers, but communicate freely with the

water by means of five spiracles on either side. The rhomboidal, broad body, the long, narrow tail, frequently furnished with two, and sometimes three, broad fins, and mostly armed with one or more rows of sharp spines along its whole length, the dirty color, and thick coat of slime with which it is covered, render them pre-eminently disgusting. Their mode of defending themselves is very effectual, and forms a striking contrast to the helplessness of the flat-fish. The point of the nose and the base of the tail are bent upwards towards each other, and, the upper surface of the body being then concave, the tail is lashed about in all directions over it, and the rows of sharp spines frequently inflict severe wounds.

Two species are found in our waters:—

R. Ocellata. — The Ocellated Ray. This species weighs about two hundred pounds; the upper part of the body is of a light brown, sprinkled with circular, black spots of various size; the belly is white.

R. Batis. — The Skate. This species is about the size of the last. The flesh is hard, but not unwholesome, and is highly prized by some. Thomas Willoughby makes mention of a single Skate of two hundred pounds weight, which was sold in the fish market at Cambridge, England, to the cook of St. John's College, and was found sufficient to dine the whole society, consisting of more than a hundred and twenty persons.

The Skates are very voracious; their food consists of any sort of fish, mollusk, annelid, or crustacean, that they can catch. So powerful are their muscles and jaws, that they are able to crush the strong shell of a crab with the greatest ease.

"But our Atlantic Rays are far from equaling the colossal dimensions of the Sea Devil of the Pacific. This terrific monster swims fast, and often appears on the surface of the ocean, where its black, unwieldy back looks like a huge stone projecting above the waters. It attains a breadth of twelve or fifteen feet, and Lesson was presented, by a fisherman of Borabora, with a tail five feet long. The Society Islanders catch the hideous animal with harpoons, and make use of its rough skin as rasps or files in the manufacture of their wooden utensils.

"Creatures so voracious and well armed as the Rays would have attained a dangerous supremacy in the maritime domains had they equalled most other fishes in fecundity. Fortunately for their neighbors, they seldom produce more than one young at a time, which, as in the shark, is enclosed in a four-cornered capsule ending in slender points, but not, as in the former, produced into long filaments."

TRYGON. — The Sting Rays. They have on the tail a strong spine, notched on both sides.

The South American Sting Ray causes the most excruciating tortures with

his long, serrated, and barbed sting. An Indian, who accompanied Richard Schomburgh on his travels through Guiana, being hit by a Sting Ray while fording a river, tottered to the bank, where he fell upon the ground, and rolled about on the sand, with compressed lips, in an agony of pain. But no tear started from the eye, no cry of anguish issued from the breast of the stoical savage. An Indian boy wounded in the same manner, but less able to master his emotions, howled fearfully, and flung himself upon the sand, biting it in the paroxysm of his anguish. Although both had been hit in the foot, they felt the severest pain in the loins, in the region of the heart, and in the arm-pits. So general a shock of the nervous system cannot possibly proceed from the sting alone, but is no doubt caused by some poisonous secretion. A robust man, wounded by a Sting Ray, died in Demarara under the most dreadful convulsions.

The genus *Trygon* is represented by several species on our coasts. Le Sueur has described five. Their sting is very poisonous, though not often, if ever, fatal in its effects.

TORPEDO. — A short, fleshy tail and circular body are the distinguishing marks of the genus. The electric apparatus consists of numerous cells, like those of the honeycomb, and subdivided by lateral diaphragms, the intervals of which contain a mucous fluid. It is situated between the pectoral fins and the head, and is well furnished with nerves. The electric shocks given by the Torpedo are not so powerful as those of the *Gymnotus*, but are sufficiently so to enable it to stun its prey.

The "Cramp-fish" of Cape Cod is, without doubt, a Torpedo. This fish has been found at Wellfleet and Truro, and formerly was quite common. A gentleman, residing at the former place, had a dog trained to fish in shallow water for flounders, which he seized with his mouth. In one of his fishing excursions, he attempted to take a Torpedo, which gave him such a shock that he dropped his prey, and ran howling away; and nothing could ever induce him again to resume his fishing.

CYCLOSTOMATA. *The Second Family of Chondropterygii Fixis.*

This family comprises those fishes which have the mouth formed into a sucker. They have no pectorals or ventrals. "Their body ends in a circular, fleshy lip, with a cartilaginous ring supporting it, and formed of the soldered palatals and mandibularies. The substance of all the vertebrae is traversed by a single tendinous cord, filled internally with a mucilaginous fluid, without contractions and enlargements, which reduces the vertebrae to cartilaginous rays not easily distinguishable from each other. The annular portion is rather more solid than the rest, but not cartilaginous through its whole circle. They have no ordinary ribs, but the gill-ribs, noted as rudi-

mental in the sharks and rays, are more developed, and united with each other in this family into a kind of cage, but there are no solid gill-arches. Instead of being comb-shaped, as in other fishes, the gills have the appearance of sacs produced by the union of the faces of the proximate ones. The labyrinth of the ear is embedded in the cranium, and the nostrils opened by a single orifice, in front of which is a blind cavity, improperly thought a spiracle. The intestine is straight and slender, with a spiral valve."

PETROMYZON.—The Lampreys. They have seven gill-openings on each side, and the skin on the upper and under parts of the tail is formed into fin-like crests, which, however, have no rays. They have strong teeth in the maxillary ring, and the inner disk of the lip, which is circular, is covered with tubercles, hard and crusted, like teeth. The tongue also, which moves backwards and forwards like a piston, and performs the suction, has two rows of small teeth.

P. Americanus.—Le Sueur gives this name to the common Lamprey Eel, as it is commonly called, of our rivers. The color of the species varies somewhat, being generally an olive brown, of lighter or darker shades. "All the upper portion of the body, mottled with dark brown, almost black, confluent patches; beneath, of a uniform dull olive. Anterior portion of the body cylindrical; posterior compressed. A slight keel upon the back. Head rounded, somewhat flattened on the upper portion in front of the eyes. Eyes moderate in size; pupils black; irides golden. Distance of the eyes from the snout, two inches. A tubular orifice is seen in front of, between the eyes, a line in its longest diameter. Seven large branchial apertures back of each eye, passing backward in nearly a straight line; the first smallest. When this species is unattached, the mouth is a longitudinal fissure. When attached, it is circular, the lip forming a ring; within, furnished with hard, horny teeth, of a yellow color. Teeth on the roof larger than those upon the sides of the mouth; lower margin of the mouth furnished with a semicircular row of compact teeth; teeth on the lip small; mucous pores obvious in front of the eyes, passing towards the snout, and almost back of the eyes. Two dorsal fins; the first commencing back of the middle of the body, three inches long, nine inches high. Between this and the second dorsal, one inch. Second dorsal, six inches long; more than one inch high in its highest part. Anal fin, a mere fringe. Caudal fin appears like the extremity of the solid portion of the body, very much compressed."

This fish is about two feet in length at maturity, and weighs from three to four pounds. In the spawning season, it ascends our various rivers, and I have seen it, in countless numbers, far in the interior of Maine, building its mounds of stone in the clear streams. According to Dr. Bartlett, "they ascend the rivers a little earlier than the shad, and move mostly in the night.

It is not known by the fishermen when they return, as they are never seen. There is a notion that they all die. They are often seen, in the summer, in pairs, at work together, constructing a little mound of stones. They build this about three feet in diameter at the base, and about two feet high, of stones from the size of an ounce bullet to that of the fist. They often aid each other in carrying the same stone. The young go down the river when the water begins to freeze. They are then from six to eight inches long."

The prevailing opinion that these fishes do not return to the sea, but die at the end of the season, is, I believe, correct. I have seen them in various stages of decay, and in such numbers as to be very disagreeable to bathers.

The remaining species are *P. marinus*, two or three feet long, marbled with brown, and a yellow ground; *P. fluvialis*, silvery, with olive or blackish spots on the back; *P. planerii*, a small river species, eight or ten inches long; *P. nigricans*, the Bluish Lamprey, and some others. They are all generally rejected as food in this country, though highly esteemed in the Old World.

AMMOCETUS.—These fishes have the skeleton so soft and membranous that there is not a bone in the whole; not even a tooth; they have the external form and gill-openings of the Lampreys, but their fleshy lip forms only a semicircle on the upper part of the mouth, which is furnished with numerous cirri. *A. branchialis* is from six to eight inches long, about the thickness of a goose-quill, and of no use but as bait for other fish. It has been accused of sucking the gills of other fishes, but perhaps falsely. It is found in the sand and mud of small streams; preys on worms, insects, and dead matter, and is, in return, preyed on by the eel.

A. Bicolor.—The Mud Lamprey. This is an American species, found in the Connecticut River, and is thus described by Le Sueur:—

"Dorsal fins low, separated; the second united with the caudal fin, which is rounded; back and sides reddish; abdomen white; the color separated by an undulating line. Anterior part of the body sub-cylindric, posterior part compressed, and tapering to the tail; nape of the neck elevated; head declivous, prolonged into a snout furnished with a lip having two short, rounded lobes; these lobes, when the mouth is closed, embrace and conceal the lower lip, which is very short; the nostrils are small, and placed in the centre of a white oval, pellucid disk, easily movable; on the inside of the upper lip, there are small granules, and at the opening of the throat small, ramified papillæ; the branchial apertures are placed in a longitudinal depression, oblique and a little curved; the first aperture is above the angle of the mouth; on each side of the head there is a whitish spot, which should seem to indicate the position of the eyes, that this species is deficient of,

in common with the *P. ruber* of Europe. The annular or ribbed appearance of the sides of this fish is owing to the muscles, which are endued with great strength, in order to enable it to burrow in the muddy sands of rivers, where it penetrates, in a serpentine manner, by means of the snout, the large lip of which performs the functions of a terrier. The European species is generally taken when the small rivers are cleansed of the superabundant sand and mud which obstruct their channels. This last is much sought after for food; but the American species is commonly rejected, as is almost every animal that either has a real or fancied resemblance to a snake. This fish is used for bait."

The genera *Myxine*, *Heptratremus*, and *Gastrobanchus* all resemble the Lampreys.

AMPHIOXUS.—This is a singular creature, and of doubtful character. It has the body compressed, the surface without scales, and both ends pointed. It has a dorsal along the whole line of the back, but no other fins. The mouth is on the under side of the body, opens longitudinally, and has a row of filaments on each side. *A. lanceolatus*, the Lancelet, is the only known species. It is an inhabitant of the sea, in which it is found, although very rarely, lurking under stones in pools left by the ebbing tide. Pallas considered it as a molluscous animal, and not a fish; but Mr. Yarrell, in his *British Fishes*, argues that it is a fish, and that, in organization, it is the lowest of the class. "The form of the fish," says Mr. Yarrell, "is compressed; the head pointed, without any trace of eyes; the nose rather produced; the mouth, on the under edge, in the shape of an elongated fissure, the sides of which are flexible; from the inner margin extend various slender filaments, which cross and intermingle with those on the opposite side. Along the sides of the body the muscles are arranged in regular order, diverging from a central line; one series passing obliquely upward and backward, and the other series as obliquely downward and backward; the anal aperture is situated one fourth of the length of the fish in advance of the end of the tail; the tail itself pointed; from the nose to the end of the tail, a delicate membranous dorsal fin extends the whole length of the back, supported by very numerous and minute soft rays; the surface of the body smooth." These characteristics leave no doubt that the animal is a fish; but that it ought to be classed with the Lamprey family is another matter. The specimen from which the description was made was not above an inch in length, very slender, and almost transparent.

THE EYELESS FISH OF THE MAMMOTH CAVE — This curious fish must bear some relation to the preceding genus. The following description was given to me by the late N. P. Willis:—

"We reached Lethe, with many stops and occasional drops of encourage-

ment and water from Stephen's flask, and here we halted to catch one of the *Eyeless Fish* who swim in this river of forgetfulness. I held the lamp while the pole net was quietly slipped under the little victim of celebrity. He *saw* no danger, poor thing! and stirred never a fin to escape being taken out of his element, and raised to a higher sphere. In size he was like the larger kind of what the boys call a 'minim,' — say an inch and a half long, — but very different in construction and color. His body was quite white, translucent, and wholly without an intestinal canal. The stomach was directly behind the brain, and all the organs of the system were *forward of the gills*, the head alone having blood or other discoloration. Under the chin he disposed of what was superfluous in his nourishment. He was curiously correspondent, indeed, to the poetized character of the place — like a fish in progress of becoming a fish in spirit-land, his dis-animalization having commenced radically at the tail, and working upward. Nothing could be more purely beautiful and graceful than the pearly and spotless body, which had heavenlifted first, leaving the head to follow. I looked for some minutes at the others swimming in the stream. They idled about, with a purposeless and luxurious tranquillity, and I observed that they ran their noses against the rocky sides of the dark river with no manner of precaution. Unhurt and unannoyed, they simply turned back from the opposing obstacle, and swam slowly away. The scientific people tell us that these blind fish once had eyes, and that the microscope still shows the collapsed socket. The organ has died out in the darkness of the subterranean river — dwindled into annihilation with lack of using."

The above is a poet's description of the fish, not that of a philosopher or man of science, who would see in this animal not an imperfect and half-formed creature, but one plainly and perfectly adapted to its condition of existence. Nature does not indulge in superfluities, and has *created* these fishes without eyes, because those organs would be utterly useless in a state of eternal darkness.

PROFESSOR AGASSIZ'S CLASSIFICATION OF FISHES. — The method of arrangement adopted by Agassiz is founded on the character of the *scales*. He divides the whole class into four orders: 1. GANOIDEANS; 2. PLACOIDEANS; 3. CTENOIDEANS; 4. CYCLOIDEANS. The fishes of the first order have a bony armor, consisting generally of scales of small size, usually covered by a coating of enamel, which gives them a peculiar brilliancy, whence the name *Ganoideans*, from the Greek word *ganos* — splendor. In some instances, as in the case of the *Sturgeon*, this armor is composed of plates of large size, with jagged edges, which lap together.

In the second order, the fishes have a skin covered with hard, bony plates,

which sometimes are of large size, but oftener are contracted to small points, as seen on the skin of the Shark, and in the prickly tubercles of the Rays. The name *Placoidæan* is derived from the Greek word *plax*—broad plate.

The fishes of the third order have the scales composed of horny matter, their posterior edges, i. e., the edges directed towards the tail, furnished with projections like the teeth of a comb. The order derives its name from this circumstance, the Greek *kteis* (*ktenos*, gen.), a *comb*, suggesting the designation *Ctenoidean*. The Perch represents this order.

The fourth order (the *Cycloideans*) derives its name from the Greek *ku-klos*—a circle. The Carp, Herring, and Salmon, whose scales have a rounded form, with smooth, simple edges, are examples which all can easily examine.

In regard to the above arrangement, Mr. Mudie well remarks, that, in comparing it "with that of Cuvier, we shall find that the *Cycloid* fishes of Agassiz are, for the most part, the *Malacopterygii* of Cuvier; and that the *Ctenoid* fishes of the former are generally the *Acanthopterygii* of the latter. Further, the *Placoid* fishes of Agassiz correspond with the principal section of the *Cartilaginous* fishes of Cuvier, the Sturgeons and *Chimere* being alone excepted. The existing *Ganoïd* fishes of Agassiz, however, were distributed by Cuvier amongst several different families.

"The application of this method of arrangement to the various forms of extinct fishes, which geological research has brought to light, has given some extremely curious results. In the first place, it may be stated as a general fact, that of the *Cycloid* and *Ctenoid* orders, there are no remains whatever in any formation anterior to the chalk, and that, consequently, the whole assemblage of existing fishes included in those two orders, probably about four fifths of those now living, had apparently no representative whatever in the more ancient seas. Even in the chalk, there seems to have been only two or three of the largest of the existing families—such as the Herring and Salmon Tribes, the Mackerel Tribe, and the Perch Tribe, which attained any considerable importance. The others are either but slightly represented at that epoch, and have subsequently increased very considerably—such as the Eels and the *Pleuronectide*; or first came in during the Tertiary period—such as the Carps and the Mullets; or present themselves, for the first time, in our own epoch, which is the case (strange to say) with the large and important Cod Tribe. Further, no family belonging to these orders has disappeared from the ocean subsequently to its first introduction; nor is there any that seems to have undergone any diminution. The other two orders, although they now form so small a part of the inhabitants of our seas, were once the sole vertebrated tenants of the globe."

SECOND DIVISION. MOLLUSCOUS ANIMALS.

IN addition to the extensive and interesting class of animals which we have just reviewed, the oceans, lakes, and rivers swarm with other forms of life, of almost infinitely-varied characteristics, some exhibiting aspects of remarkable beauty, while others are extraordinary for their grotesque ugliness; yet it will be seen that all are beautifully adapted, by their organizations and attributes, to the order of being where the Creator has placed them.

Cuvier divides the Mollusea into six classes, as follows:—

The CEPHALOPODS, whose body has the form of a sac, enclosing the branchiae, and open above, whence protrudes the head well developed, and crowned with certain strong, fleshy, elongated productions, by means of which the animals progress and seize upon objects. The Cuttle-fish is a representative of this class.

The PTEROPODS.—In these the body is not open, and the head has no appendages, or if any, they are very minute, locomotion being effected by two wings, or membranous fins, placed on the sides of the neck, and in which the branchial tissue is often spread.

The GASTEROPODS, which crawl on the belly, on a fleshy disk, sometimes compressed into a fin. Nearly all of them have a distinct head.

The ACEPHALES.—These have the mouth concealed in the base of the cloak, which also encloses the branchiae and the viscera, and opens either throughout its whole length, or at both its extremities, or at one only.

The BRACHIOPODS.—This class comprehends the species which, enclosed also in a cloak, and without an apparent head, have fleshy or membranous arms, garnished with ciliae of the same nature.

The CIRRHOPODS.—This class comprises those mollusks which have the attributes of the preceding classes, but differ from them in having numerous horny articulated members, and in a nervous system more allied to that of the Annulose animals.

They all have a soft body, which is covered by a flexible skin (the so-called mantle), under or over which calcareous or horny shells are formed by secretion. The chief organs are symmetrical and in pairs, generally disposed in a curve, so that the mouth is proximate to the opposite extremity of the intestinal canal. The blood is white, flows from the heart to all

parts of the body, and finds its way back again to that organ, after having been refreshed in the lungs or branchial apparatus. The nervous system consists of ganglions connected by nervous filaments. From the fishes, the mollusks are distinguished by the absence of an internal skeleton and spinal marrow, and also by the great difference of their respiratory and locomotive organs.

CLASS I. THE CEPHALOPODS.

The members of this class manifest a most extraordinary structure. They consist of two distinct parts. The body, which, in form of a sac, opens to the front, encloses the branchiae and digestive organs, and the well-developed head, provided with a pair of sharp-sighted eyes, and crowned with a ring of feet, arms, or feelers. It is to this formation that the Cephalopod owes its scientific name; for, as the feet grow from the circumference of the mouth, it literally creeps upon its head.

They compose but one order, which is divided into the following genera, according to the nature of the shell: *OCTOPUS*, the Poulpes; *ARGONAUTA*, the Argonauts; *LOLIGO*, the Sleeve-fish; *SEPIA*, the Cuttle-fish; and *NAUTILUS*.

All the Cephalopods are marine animals, and breathe through branchiae or gills. These organs are concealed under the mantle, in a cave or hollow, which alternately expands and contracts, and communicates by two openings with the outer world. The one in form of a slit, serves to receive the water; the other, which is tubular, is used for its expulsion.

The first four genera—and which comprises by far the great majority of living species—have only two sets of gills; while the last genus, *Nautilus*, which in the present epoch is only represented by a few species, has four, two on each side.

According to the number of their arms or feet,—for these remarkable organs serve equally well for creeping or seizing prey,—the first group again divides into two classes, Octopods and Decapods; the former having only eight sessile feet, the latter ten, two of which are elongated like feelers. The feet are studded on the inner surface with small circular disks or suckers, either sessile or pedunculated. The sessile cups of the Octopods serve them as suckers, by means of which they attach themselves so firmly to their prey, that once seized, it cannot possibly disengage itself from the murderous embrace.

The stalked cups of the Decapods cannot, indeed, serve them as suckers; but, to make amends for this want of adhesive powers, they are provided with a sharp hook fixed in the centre, and are the more formidable from

being able to move upon their stalk in every direction. The Decapod can also voluntarily draw in or stretch out its claws like the cat, and thus runs no risk of entangling itself when shooting backwards through the water. The size of the arms and the arrangement of the cups differ very much in the various species. Thus, in the common Octopus, the arms are almost of equal length; in the Philonexis there are four long and four short ones; and in the Argonaut two of them expand sail-like at their extremity. In the decapodal Calamaries and Sepias, the two feeler-like arms are considerably lengthened, and in the Loligopsis, the disproportion is so great that these organs are several times longer than the whole body. In the Octopods, which generally lead a more sedentary, creeping life, and clinging to stones, seize the passing prey, the arms, in accordance with their wants, are always longer, more fleshy, and stronger than in the actively swimming Decapods.

In some species we find the arms separated; in others, they are united by a membrane. The Octopus has on each arm a double row of cups or suckers, the Sepia four rows, the Eledone but one. So wonderful are the variations which nature, that consummate artist, plays upon a single theme! so inexhaustible are the modifications she introduces into the formation of numerous species, all constructed upon the same fundamental plan, and all equally perfect in their kind!

When a Cephalopod has got hold of a fish or crab, the arms, by sucking or hooking, instantly convey the helpless prey to the mouth, where it is pitilessly crushed by two powerful horny or calcareous jaws, fitting one over the other like the mandibles of a tortoise.

Besides their arms, by help of which the Cephalopods either swim or creep, the forcible expulsion of the water through the air-tube serves them as a means of locomotion in a backward direction. By those which have an elongated body, and comparatively strong muscles, this movement is performed with such violence that they shoot like arrows through the water, or even, like the flying-fish, perform a long curve through the air. Thus Sir James Ross tells us, that once a number of cuttle-fish not only fell upon the deck of his ship, which rose fifteen or sixteen feet above the water, and where more than fifty were gathered, but even bolted right over the entire breadth of the vessel, like a sportsman over a five-barred gate!

Finally, the fin-like expansion of their mantle renders the nimble Decapods good service in swimming. In the Sepias, this finny membrane runs along the sides of the body; in the Calamaries it is situated at its extremity.

The skin of the Cephalopods offers some remarkable peculiarities. It is covered with variously-colored spots, which, as long as the animal is quiet, are nearly invisible, but as soon as it is excited, increase to about sixty times their former size; and then, by alternate contractions and expansions,

rapidly appear and disappear, so that the same Cephalopod is one moment white and the next yellow or brown. The surface of the skin also changes its nature under the influence of excitement. For instance, in the Octopus, when tranquil, it is perfectly smooth, but as soon as the animal is disturbed, the body, the head, and even the arms appear covered with tubercles and elevations, where an instant before nothing of the kind was to be seen.

It might be supposed that the Cephalopods, by their swiftness, their arms, and their powerful jaws, were sufficiently provided with means of attack or defence; but nature has besides favored many of them with a remarkable secretory organ, producing a black fluid, and opening into the air-tube. When the animal is in danger, or wishes to avoid observation, it ejects a sufficient quantity of this inky liquid to form a thick cloud in the water, which serves to conceal it from its foe. This black sepia-juice is, as we all know, used as a pigment, the durability of which may be inferred from the fact that even the contents of the ink-bag of fossil species have still been found useful. It has been affirmed that grains of wheat, buried with Egyptian mummies three thousand years ago, have germinated; but it is surely still more astonishing that an animal secretion, the origin of which is lost in the dark abyss of countless ages, should have remained so long unaltered.

The Cephalopods are scattered in countless numbers over the whole ocean. Some, like the Argonaut, constantly frequent the high seas; others, like the common Octopus, invariably cling to the coasts. Two pelagic species—*Ommastrephes giganteus* and *sagittatus*—leave annually, the first the South, the second the North Polar Sea, and wander in enormous shoals to the coasts of Chili and Newfoundland. The Sepias and Calamaries appear in spring along the coasts, where they tarry a shorter or longer time, according to the difference of species, and then withdraw again into the deep.

Almost all Cephalopods are nocturnal or vespertine in their habits. At night they abound on the surface of the seas, but are not to be seen during the day. With the exception of the Poulp or Octopus, which leads a solitary life on rocky coasts, they love the society of their kind, and wander in troops along the shores and in the deeper ocean. They are all of them extremely voracious, destroy on shallow banks the hopes of the fisherman, devour on the high seas countless myriads of young fish and naked mollusks, and kill, like the tiger, for the mere love of carnage. Thus they would become dangerous to the equilibrium of the seas, if nature, to counterbalance their destructive habits, had not provided a great number of enemies for the thinning of their ranks. They form the almost exclusive food of the sperm whales and dolphins, and various sea-birds love to skim them from the surface of the ocean. Tunnies and bonitos devour them in vast numbers, the cod consumes whole shoals of squids, and man catches many millions to serve him as a bait for this valuable fish.

At Teneriffe, in the Brazils, in Peru and Chili, various species of Cephalopods are used as food. Along the eastern shores of the Mediterranean, the common *Sepia officinalis* is so numerous that the cuttle bones may be seen heaped by the waves into a ridge, which fringes the sea for miles. "As in ancient times," says Edward Forbes, "these mollusks constitute now a valuable part of the food of the poor, by whom they are mostly used. One of the most striking spectacles at night on the shores of the Aegean is to see the numerous torches glancing along the shores, and reflected by the still and clear sea, borne by poor fishermen, paddling as silent as possible over the rocky shallows in search of the cuttle-fish, which, when seen lying beneath the water in wait for his prey, they dexterously spear, ere the creature has time to dart with the rapidity of an arrow from the weapon about to transfix his soft but firm body."

Animals exposed to so many enemies must necessarily multiply in an analogous ratio. Their numerous eggs are generally brought forth in the spring. In the species inhabiting the high seas they float freely on the surface, carried along by the currents and the winds, and form large gelatinous bunches, or cylindrical rolls, sometimes as large as a man's leg. The eggs of the littoral Cephalopods appear in the form of small transparent grapes, or black pear-shaped sacs, the stems of which are attached to algae, or any other convenient body. The young animals, hatched by the warmth of the sun, emerge from the husk perfectly formed, and give immediate proof of their social nature by herding together in large bodies.

According to trustworthy testimonies, some species of Cephalopods attain an astonishing size. Thus Péron saw, near Van Diemen's Land, a *Sepia* as big as a tun, rolling about in the waters. Its enormous arms had the appearance of frightful snakes. Each of these organs was at least seven feet long, and measured seven or eight inches round the base. Not satisfied with reality, some writers have magnified the size of the cuttle-fishes to fabulous dimensions. Thus Pernetti mentions a colossal cuttle-fish, which, climbing up the rigging, overturned a three-masted ship; and Pliny notices a similar monster, with arms thirty feet long, and a corresponding girth.

All the *Acetabuliferous*, or cup-bearing Cephalopods, are destitute of an outward shell, with the sole exception of the Argonaut, which poets, ancient and modern, have celebrated as the model from which man took the first idea of navigation. Its two sail-like arms expanding in the air, and the six others rowing in the water, the keel of its elegant shell is pictured as dividing the surface of the tranquil sea. But as soon as a breath of wind curls the waters, or the least danger appears, the cautious Argonaut takes in his sails, draws back his oars, creeps into his shell, and sinks instantly into a securer depth.

Unfortunately, there is not a word of truth in this pleasing tale. Like the commonest cuttle-fish, the Argonaut generally creeps about at the bottom of the sea, or when he swims, he places his sails close to the shell, stretches his oars right out before him, and shoots backwards like most of his class, by expelling the water from his respiratory tube.

As he sits loosely in his shell, he was supposed by some naturalists to be a parasite, enjoying the house of the murdered owner; but this is perfectly erroneous, as the young in the egg already show the rudiments of the future shell, and the full-grown animal repairs by reproduction any injury that may have happened to it.

The Nautili, which likewise are provided with an external shell, are Cephalopods of a very peculiar kind. Here, instead of mighty cup-bearing or sharp-clawed arms, we find a great number of contractile and slender tentacula. The handsome pearl-mother and spirally-wound shell is divided by transverse partitions, perforated in the centre into a large number of chambers. The animal takes up its abode in the foremost and largest, but sends a communicating tube or siphon, the use of which is as yet but little known, through all the holes of the partitions to the very extremity of the spirally-wound shell. Recent researches in the South Sea have brought to light three different kinds of Nautilus: the *Pompilius*, found at the New Hebrides and Feejee Islands; the *Umbilicated* Nautilus of the Solomon Islands, New Georgia, New Breton, and New Ireland; and *N. Macrophalatus*, found at the Isle of Pines and New Caledonia.

CLASS II. THE PTEROPODS.

This class, although multitudinous in individuals, comprehends but one order, and a small number of species. The Pteropods (*Wing-footers*) are thus named from their peculiar organs of locomotion, which are fins placed like wings at each side of the mouth. Consequently they cannot creep, and therefore frequent the high seas, where they swarm in countless myriads. They are small creatures, not exceeding an inch in length, and yet their numbers are so vast that they constitute the principal part of the food of the gigantic whale. The genera are CLIO, which has an oblong, membranous body, without a cloak, and a head formed of two rounded lobes; CYMBULIA, which has a cartilaginous envelope in the shape of a boat or shoe, and a body so transparent that we can see the heart, brain, and the viscera through the envelope; PNEUMODERMON, which has an oval body, and furnished with lips, and two bundles of numerous tentacula, terminated each by a sucker; HYALEA, the Hyales, have two very large wings, no tentacula, and cloak

slit on the sides, and a shell slit in a corresponding manner; *CLEODORA*, the Cleidores, are like the preceding genus, only their shell is not slit along the margin.

Some of these little animals are of a beautiful rose color, and others are blue and violet, variegated with spots of red.

Godwin Austen describes the Pteropods as "the winged insects of the sea, reminding us, in their free-circling movements and crepuscular habits, of the gnats and moths of the atmosphere; they shun the light, and if the sun is bright, you may look in vain for them during the livelong day — as days sometimes are at sea; a passing cloud, however, suffices to bring some Cleodora to the surface. It is only as day declines that their true time begins, and thence onwards the watches of the night may be kept by observing the contents of the towing-net, as the hours of a summer day may be by the floral dial. The Cleodore are the earliest risers; as the sun sets, *Hyalea gibbosa* appears, darting about as if it had not a moment to spare; and, indeed, its period is brief, lasting only for the Mediterranean twilight. Then it is that *Hyalea trispinosa* and *Cleodora subula* come up; *Hyalea tridentata*, though it does not venture out till dusk, retires early, whilst some species, such as *Cleodora pyramidata*, are to be met with only during the midnight hours and the darkest nights. This tribe, like a higher one, has its few irregular spirits, who manage to keep it up through the whole night. All, however, are back to their homes before dawn surprises them.

CLASS III. THE GASTEROPODS.

This numerous class, well represented by the Snail and Slug, is interesting from the exceeding beauty of the external covering which many of the genera provide for their protection. The greater portion of the sea-shells which adorn our cabinets are the productions of the Gasteropods. No architect ever constructed such magnificent and elaborate palaces, and no artist ever blended such rich and glowing colors, or enlivened his works with tints of such exquisite delicacy.

The animals of this class generally creep upon a fleshy disk under the belly, whence the name *Gasteropods*—Stomach-footers. The back is covered with a cloak, of greater or less extent, and of a various figure, which secretes a shell in the greater number of the genera. Their head, placed in front, is more or less distinct, according as it is more or less drawn in under the cloak. It is furnished with tentacula of comparatively small size, and which do not encircle the mouth, their number varying from two to six, although sometimes they are absent. They are organs of touch and smell.

The eyes are very small, sometimes placed upon the head, sometimes at its base, either to the side, or at the tips of the tentacula. The class is divided into five orders, the characters of which are drawn from the position and form of the branchiæ.

"The PULMONEA breathe the atmosphere, receiving the air within a cavity whose narrow orifice they can open and close at will: they are hermaphroditical, with reciprocal copulation: some have no shell, others carry one, which is often truly turbinated, but never furnished with an operculum.

"The NUDIBRANCHIATA have no shell, and carry their variously-figured branchiæ naked upon some part of the back.

"The INFEROBRANCHIATA are similar, in some respects, to the preceding, but their branchiæ are situated under the margins of the cloak.

"The TECTIBRANCHIATA have their branchiæ upon the back, or upon the side, covered by a lamina, or fold of the cloak, which almost always contains a shell more or less developed; or sometimes the branchiæ are enveloped in a narrow fold of the foot.

"These four orders are hermaphroditical.

"The HETEROPODS carry their branchiæ upon the back, where they form a transverse row of little tufts, and are, in some instances, protected, as well as a portion of the viscera, by a symmetrical shell. What best distinguishes them is the foot compressed into a thin vertical fin, on the margin of which a little sucker often appears—the only trace left of the horizontal foot of the other orders of the class.

"The PECTINIBRANCHIATA have the sexes separated: their respiratory organs consist almost always of branchiæ composed of lamellæ united in a pectinated form, and which are concealed in a dorsal cavity, opening with a wide gape above the head. Nearly all of them have turbinated shells, with the mouth sometimes entire, sometimes emarginate, sometimes produced into a siphonal canal, and generally capable of being more or less exactly closed by an operculum attached to the foot of the animal behind.

"The SCUTIBRANCHIATA have branchiæ similar to those of the Pectinibranchiata, but they are complete hermaphrodites, and require no union with a second to effect impregnation: their shells are very open, and in several like a shield; they never have any operculum.

"The CYCLOBRANCHIATA are hermaphrodites of the same kind as the Scutibranchiata, and have a shell, consisting of one or several pieces, but in no case turbinated nor operculate: their branchiæ lie under the margin of their cloak, as in the Inferobranchiata."

"Nature," it has been well remarked, "never passes abruptly from one type of organization to another;" and thus we find a long series of

intermediate and gradually-progressive forms, between the naked Gasteropods and those that are covered with a perfect spiral shell. First, there is a rudimentary internal or external shell, nearly covering and protecting the most important organs; by degrees it expands and shields the whole animal, and the first signs of a spiral development make their appearance; and at last the snail's palace appears in all its perfection and beauty.

ORDER I. THE PULMONEA.

These mollusks breathe the atmosphere through a hole which opens under the margin of their cloak, and which they can dilate or contract at pleasure. They have no branchiæ, but only a network of pulmonary vessels, which creep upon the walls, and more particularly upon the ceiling of their respiratory cavity. Some are terrestrial, and others aquatic; the latter are compelled, at intervals, to come to the surface to receive within their pulmonary cavity the air for respiration. They are all hermaphrodites.

The terrestrial Pulmoneans are separated into several genera, the best known of which are the following:—

LIMAX.—The Limaceæ have no apparent shell. The group comprises the family of slugs, one species of which, *L. rufus*, was once thought a valuable remedy for diseases of the chest, taken in the form of a broth. **VAGINULUS, HELIX, CLAUSILIA, and ACHATINA** comprehend the common snails. Of the last, Somerby remarks, that they are, for the most part, African and West Indian species. Two species, *A. zebra* and *A. virginea*, are distinguished for their beautiful shells.

The aquatic Pulmoneans, as they are obliged to come to the surface to breathe, live in fresh waters, or near the shores and mouths of rivers. The genera are **ONCHIDIUM, PLANORBIS, LIMNEUS, PHYSÆ, SCARABES, AURICULA, and MELAMPES**, the last two of which are noted for their magnificent shells.

ORDER II. NUDIBRANCHIATA.

Cuvier describes this family as having neither a shell nor pulmonary cavity, but their branchiæ exposed naked upon some part of the back. They are all hermaphroditical and marine: they swim in a reversed position, the foot applied against the surface, and made concave like a boat, and use the edges of the cloak and the tentacula as oars to assist their progression. The principal genera are **DORIS**, found on the shores of all seas; **TRITONIA**, a curious group, which has two rows of tufted branchiæ along

the back, and upon the head a very large membranous fringed veil, which curves in its contraction under the mouth. *T. fimbria* is a beautiful Mediterranean species, of a grayish color, spotted with white. The remaining genera are *SCYLLÆA*, *GLAUCUS*, *EOLIDIA*, and *TERGIPES*.

Nothing can be more elegant or various than the form and arrangement of the gills in most of the Nudibranchiates. In the *Glauci* and *Scyllæa* we see at each side of the elongated body long arms, branching out into tufted filaments, and on the back of *Eolides* the gills are arranged in rows, while in the *Dorides* they form a regular wreath, or garland, round the lower intestinal aperture. The beauty of these animals corresponds with their mythological names; for every part of them which is not sparkling like the purest crystal, shines with the liveliest colors. Some of them creep along the coast; others seek the open sea, where they attach themselves to floating algae, or swim about upon their back, by rapidly contracting the border of their mantle.

Although they are represented in all seas, they delight particularly in the warmer latitudes. Though provided with no defensive weapons, they are not left altogether to the mercy of their enemies. Some conceal themselves under stones; and some, on contracting, cast off parts of their mantle, leaving it in possession of their hungry foe, while they themselves make their escape.

ORDER III. INFEROBRANCHIATA.

The Inferobranchiates resemble the *Dorides* and *Tritones* in their habit and organization; but their branchiæ, instead of being situated upon the back, are on the sides of the body, under the projecting margin of the cloak, where they form two long series of leaflets. They are incapable of swimming. The genera are *PHYLLIDIA* and *DIPHYLLIDES*. The former group belongs to the Indian Ocean; the latter lives in stagnant waters, and in rivulets, adhering to stones and aquatic plants.

ORDER IV. TECTIBRANCHIATA.

In this order the branchiæ are attached along the right side, or upon the back, in the form of leaflets, more or less divided, are more or less covered by the mantle, which generally contains a small shell. This order comprehends several groups, of which the most remarkable is the genus

APHYSIA. — The mantle of this animal forms two wide folds on the back. When these are opened, the delicately-fringed branchiæ appear in a deep

hollow on the right side, covered by a thin, transparent, horny shell. These mollusks resemble a great naked snail. They dwell in every sea, frequenting chiefly rocky shores, where they creep along, feeding upon the alge. Some species, however, make use of their mantle folds for swimming. A peculiar gland pours out, through an orifice near the vulva, a limpid humor, which is said to be very acrid, if not absolutely poisonous, in some species. A purple liquid also oozes from the edges of the cloak, when they are alarmed, which discolors the water, and conceals them from their foes.

ORDER V. THE HETEROPODA.

The Heteropods have the foot compressed into a vertical muscular lamina, which they use as a fin, and on the edge of which, in several species, is a sucker, in the form of a hollow cone, that represents the disk of the other orders. The body, which is a transparent, gelatinous substance, is elongate, sheathed with a muscular layer, and terminated with a compressed tail. The mouth has a muscular mass, and a tongue garnished with little hooks. They have the power to inflate the body with water, the object of which is not known; and they swim in a reversed position. The genera are FIROLA, ATLANTA, and CARINARIA.

The *Carinariae* are very curiously formed animals, carrying on their back a shell fastened to a stalk, under which the fringed branchiae project. On the under side of the body the foot forms a round disk, furnished with a sucking-cup. The whole animal seems to be made up of disjointed parts. The species live far away from shore, and are generally found swimming about, or attached by the foot to some floating objects. The most beautiful species inhabits the Indian Ocean, and produces a shell worth from two to three hundred dollars.

ORDER VI. THE PECTINIBRANCHIATA.

This order is, beyond comparison, the most numerous of the class, since it comprehends almost all the univalve spiral shells, and several which are simply conical. The branchiae, composed of numerous leaflets or fringes, ranged parallelly like the teeth of a comb, are affixed in one, two, or three lines, according to the genera, to the floor of the pulmonary cavity, which occupies the last whorl of the shell, and which communicates outwards by a wide gape between the margin of the cloak and the body. Two genera

only — *Cyclotoma* and *Helicina* — have, instead of branchiæ, a vascular network, clothing the ceiling of a cavity in all respects the same as that of the order; and they are the only ones which respire the atmosphere, water being the medium of respiration to all the rest.

All the Pectinibranchiata have two tentacula and two eyes, raised sometimes on pedicles; a mouth in the form of a proboscis, more or less lengthened; and separate sexes.

Cuvier divides the order into four families: the *Trochoides*, which have a shell with an entire aperture, without sinus, or canal for siphon, and furnished with an operculum, or some organ as its substitute; the *Capuloides*, which have a widely open shell, without an operculum or emarginative canal; the *Buccinoïdes*, distinguished by a spiral shell, the mouth of which has, near the end of the columella, a sinus or canal, for the passage of the siphon, which is formed by an elongated fold of the cloak; and the *Strombusidæ*, which comprise the shells, with a canal either straight, or bent to the right, the external lid of the aperture becoming, at its maturity, more or less dilated, and always marked with a sinus near the siphonal canal, whence the head issues when the animal comes out.

In the first family we find several fine shells, — as the *Trochus turritus*, *Turbo*, *Ampulonia*, and *Nerita*. To the third family belong those splendid specimens, known as *Cones*, *Volutæ*, *Buccinum*, and *Murex*, all magnificent shells, beautifully colored. The last is remarkable for its elongate canal, and the numerous spines which cover the whole, giving it something of the appearance of a *chevaux-de-frise*. The fourth family contains the *Pteroceras scorpio*, a shell highly valued by conchologists.

ORDER VII. TUBULIBRANCHIATA.

These mollusks have a shell formed more or less like an irregular tube, spiral only at its apex, and fixed permanently to other bodies. There are three genera: VERMETUS, which has a tubular shell, whose whorls, at an early age, form a kind of spine, and continued on in a more or less irregularly bent or twisted tube, like the tubes of the Serpula; MAGILUS, with a tube at first quite regularly spinal, and then extended in nearly a straight line. It is common in the coral rocks of the Isle of France, and its tube sometimes reaches the length of three feet; and SILIQUORIA, which has the irregular tube of the Vermetus, but there is a fissure on the whole length of the shell.

ORDER VIII. SCUTIBRANCHIATA.

These Gasteropods are clothed with shells quite open, and the greater number are not in any degree spiral, and cover the animals in the manner of a shield.

They are separated into two great genera: *Haliotis* and *Fissurella*, the first of which is the most richly embellished of the class.

ORDER IX. THE CYCLOBRANCHIATA.

These animals have their branchiae in the form of little leaflets, or pyramids, attached in a circle, under the margins of the cloak. There are only two genera: *Patella*, the Limpets, and *Chiton*, the Chitons.

The Limpets live on rocks or stones, to which they cling so fast by suction, that it requires the introduction of a knife between the shell and the stone to detach them. It has been calculated that the larger species are thus able to produce a resistance equivalent to a weight of one hundred and fifty pounds, which, considering the sharp angle of the shell, is more than sufficient to defy the strength of a man to raise them. They often congregate in large numbers in one place, and an old writer compares them to nail-heads stuck into the rock. They live upon the green sea-weed, that we find covering at ebb tide the stones with a thin emerald layer; and when these are submerged by the flood, they creep along on the bottom, slowly grazing on these marine pasture-grounds.

The Gasteropods surpass all the Molluscous animals in the beauty of the form of the shells, and the splendor and delicacy of their colors. The *Haliotides* are handsome mother-of-pearl shells, frequently used for the inlaying of boxes. If the spiral shells could be drawn out, they would all be found to consist of a tube gradually widening from the apex to the base. "But," says an enthusiastic conchologist, "what an immense variety of forms and ornaments, what a prodigality of splendid tints, has not Nature spread over their countless species! The same fundamental idea appears to us in a thousand different forms, one still more elegant, in comparison, than the other. Thus the passion of the shell-collector is as conceivable as that of the lover of choice flowers; and when we hear that rich tulip amateurs have given thousands of dollars for a single bulb, we cannot be surprised that hundreds are paid for the *Scularia pretiosa*, or the *Cypraea aurora*, which the New Zealand chiefs used to wear about their

necks. The giant Nerite commands any price; and many of the *volute*, *cones*, *mitres*, and *harps* are purchased at a price exceeding several times their weight in gold."

However different the form of the shell may be, its use is invariably the same, affording the soft-bodied animal a shield, or retreat from injuries. In this respect it is not uninteresting to remark, that those species which inhabit the coasts, and are more exposed to the rolling of the waves, have a thicker and stronger shell than those which live in greater depths, and that the fresh water mollusks have generally a much more delicate and fragile coat than those which live in the ocean. The greater the necessity of protection, the better has Nature provided for the want. Thus most of the larger sea-snails, besides possessing a stone-hard dwelling, are also furnished at the extremity of the foot with an opereulum or calcareous lid, which fits like a door upon the opening of their house, and closes it like a fortress against the outer world. But no animal exists that is safe against every attack, for the large sea-birds sometimes carry the ponderous snails, whose entrance they cannot force with their beaks, high up into the air, and let them fall upon the rocks, where they are dashed to pieces.

The ordinary mode of locomotion of the sea-snails is by creeping along on their foot; those that have a very heavy house to carry, such as the *Cassis*, or the *Pteroceras*, move along very slowly, while others, such as the *Oliveæ*, that are possessed of a comparatively strong foot, have rapid and lively movements, quickly raise themselves again when they have been overturned, and are even able to swim a short distance. The swiftness of the sea-snails is not always in proportion to the size of their foot, as the *patella* creep but very slowly along on their broad disk. In some species, that remain fixed to the rock to which they first attach themselves, as small free-swimming larvae, the foot is naturally reduced to the state of an adhesive organ.

Most of the Gasteropods are so heavily clothed, that they are necessarily confined to the rocky or sandy sea-bottom. The *Ianthina*, however, has under its foot a vesicular organ, like a congeries of foam-bubbles, that serves as a buoy to support them at the surface of the water. When the sea is quiet, they appear in vast shoals on the surface, with their foot turned upwards; but as soon as the winds ruffle the ocean, they empty their air-cells and sink to the bottom, pouring out at the same time a dark red fluid, which, according to Lesson, furnished the celebrated purple of the ancients. The transparent shell is also of a beautiful violet color.

The sea-snails inhabit different zones of depth; some live only within reach of the spring floods, and are therefore almost constantly out of the water; others dwell a little lower, so as to be bathed at least by every flood;

and others, again, sojourn constantly near low-water mark. But by far the greater number dwell completely beyond the limits of the flood oscillations, at various distances from the surface, to a depth of five hundred feet and upwards.

The sea-snails are either predaceous or herbivorous; the former bore through the shells of the sedentary mussels with their rasp-like tongue, or feast upon the dead animals which chance brings in their way. They seem to have very acute olfactory organs, for animal substances let down in a net to the bottom often draw thousands together in one night. In their turn, they serve as food to many other inhabitants of the ocean; but their deadliest enemies are the sea-stars, that not only swallow the young fry, but also seize with their long arms the full-grown Gasteropods, and clasp them in a murderous embrace.

CLASS IV. ACEPHALES.

The mollusks of this class owe their scientific name to the circumstance that they have no apparent head, the word being derived from the Greek *a*, no, and *kephalee*, head. Their mouth is concealed between the folds of their cloak, which latter is doubled in two, and encloses the body as a book is enclosed between its covers. A calcareous bivalve shell — sometimes multivalve — covers the cloak. The brain is situated over the mouth, which is destitute of teeth, and can seize only such objects as the water floats into it. The class is divided into two orders — the *Testaceans acephales*, and the *Shell-less*. The first order is by far the most numerous, as all bivalves, and nearly all multivalves, belong to it.

ORDER I. ACEPHALA TESTACEA. THE BIVALVES.

The *Testacea* are distinguished from the preceding mollusks by a more simple organization. The Gasteropod marches along by the aid of its powerful foot, and can thrust from its shell a well-developed head, while the Bivalve has neither foot nor head. Many of the bivalves, however, have eyes, or ocular spots, which enable them to distinguish light from darkness; and some even possess auditory organs.

When danger menaces the Sea-snail, it withdraws its head, and closes the entrance of its hermitage with a lid; but the bivalve shuts its folding-doors when it wishes to avoid a disagreeable intruder. A strong elastic ligament connects the two valves, and opens them wide as soon as the

muscular contraction which closed them ceases to act. In many the folds of the mantle are quite open in front, as, for instance, in the oyster, which, on opening its shell, fully discloses its internal parts; in others they form a closed sack, with several openings—an anterior one for the passage of the foot, and two posterior ones for the ingress and egress of the water, which the animal requires for respiration. These posterior openings are often prolonged into shorter or longer tubes, sometimes separate, and sometimes grown together.

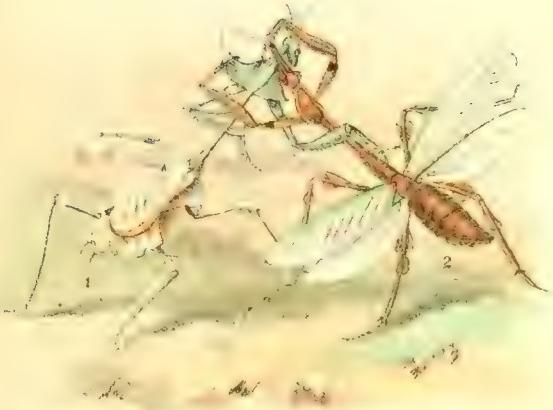
The use or purpose of this formation becomes evident when we consider the mode of life of the animals thus endowed. Almost all of them live buried in the sand or mud, where they spend the whole or greater part of their life. Were their mantle open, they would inevitably be suffocated—a danger against which their long respiratory tubes, emerging into purer water, effectually protect them. Their strong muscular foot serves them as an excellent spade for rapid concealment in the sand, when an enemy approaches, and some species make use of it for creeping or hopping. The common cockle stretches it out as far as possible, presses it against the ground, springs up by suddenly contracting it, and hops rapidly along by quickly repeating the same manœuvre. In other species the movements are much more limited. Thus the *Solenacea*, or Razor-sheaths, content themselves with moving up and down in the vertical holes which they have dug, and which they never leave.

Most of the siphonous bivalves inhabit sandy and muddy coasts in such vast numbers that the flat strand is often covered with their debris; but there are some which bury themselves in wood or stone.

The Testaceous Mollusks are arranged in families, in the first of which is the genus

OSTREA.—The Oyster. From its commercial value, and the rank it holds in our domestic economy, the Oyster may be styled the chief of the Molluscous animals. Although it is a universal favorite, and is consumed in immense quantities by all classes, our coasts appear to be capable of producing an inexhaustible supply. Its fecundity is extraordinary, a single oyster reproducing itself by a progeny of more than *twelve hundred thousand*.

The Roman naturalist Pliny called the oyster "the palm or glory of the table," and modern epicures will not question the excellence of his judgment. This valuable bivalve congregates in enormous banks, particularly on rocky ground, though it is also found on a sandy or even a muddy bottom. In the tropical zone it frequently attaches itself to the roots and branches of the mangroves, and at ebb tide swings about as the wind agitates its movable support. It inhabits all the European seas as



1 *EMPSA GONGYLODES*
2 *EMPSA LOBIPES*



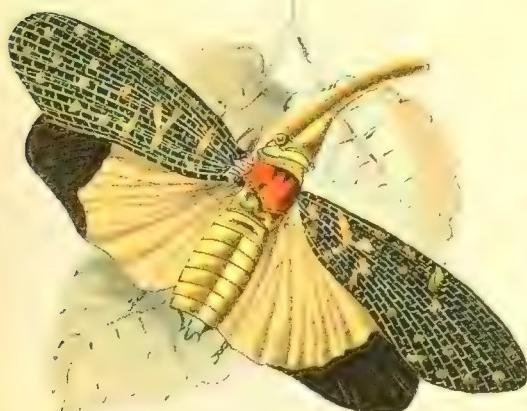
1 *ACRIDA VIRIDISSIMA*
2 *ACRIDA VERRUCIVORA*
3 *PTEROHYLLA OCCELLATA*



LOCUSTA FLAVA



FULGORA CASTRESII



FULGORA CANDELARIA.



PHYLLIUM SICCIFOLIA.
(Walking-leaf.)

far as the Westenfiord, where it finds its northern boundary, lat. 68° N.; but the British waters may be considered as its headquarters, for nowhere is it found in greater abundance, and of a richer flavor. In the United States it abounds on the Atlantic coast from Massachusetts to the extreme southern limit; but the Virginian and Carolinian oysters are the most esteemed.

Three sorts of oysters are distinguished in the trade. The first comprises those which are dredged from the deeper banks. These are the largest sized, but also the least valued. The second consists of those that are gathered on a more elevated situation. Being accustomed to the daily vicissitudes of ebb and flood, they retain their water much longer, and can, therefore, be more easily transported to greater distances than the former. Those are preferred that grow on a clean bottom, near the estuaries of rivers. The third and most valued sort of oysters are those that are preserved in artificial basins or parks.

OYSTER CULTURE.—This branch of industry was known to the Romans; and Pliny names Sergius Orata, a knight, as the first who established an oyster-park, and realized large sums of money by this ingenious invention. At present, England and France take the lead in this important business. Their oyster-parks, or gardens, are generally large walled basins, communicating by sluices with the sea, so that the water can be let in and out. As infusoria and microscopic algae are produced in much greater numbers in these tranquil basins than in the boisterous sea, the oysters find here a much more abundant food, and being detached one from the other, they can also open and close their shells with greater facility, so that nothing hinders their growth.

Thus fostered and improved by art, they are vastly superior to the rough children of nature that are sent at once to market, and condemned to the knife immediately after having been dragged forth from their submarine abode. The highly-prized green oysters owe their color to the numbers of ulvæ, enteromorpha, and microscopic algae that are usually generated in these parks, and communicate their verdant tinge to the animal that swallows them.

Considering the increasing wealth and luxury of our nation, which annually raises the demand for oysters, the small number of artificial oyster-beds along our coasts, and, above all, the improvident and ruinous manner in which the delicate mollusks are collected on their native banks, it is very much to be feared that ere long both fisherman and consumer will have to deplore an exhausted supply. It is, therefore, extremely desirable that new natural banks should be created; and fortunately the manner in which the mollusks are developed, and several successful examples, warrant its practicability.

The oyster spawns from June to September. Instead of immediately abandoning its eggs to their fate, as is the case with so many sea-animals, it keeps them for a time in the folds of its mantle, between the branchial lamellæ; and it is only after having thus acquired a more perfect development that the microscopic larvæ, furnished with a swimming apparatus and eyes, emerge by thousands from the shell, and are then driven about by the floods and currents, until they find some solid body, to which they attach themselves for life. The oyster produces in one single summer a couple of millions of young, which, however, mostly perish during the first wandering stage of their existence.

Thus we see what rich rewards the industry of man might expect to earn by protecting and fixing the oyster-larvæ at an early date; and that this could easily be done in many places, is proved to us by the artificial oyster-breeding that has now been successfully carried on for many ages in the Lake of Fusaro.

Between the Lucrine Lake, the ruins of Cuma, and the promontory of Misenum, lies a small salt-water lake, about a league in circumference, generally from three to six feet deep, and reposing on a volcanic, black, and muddy bottom. This is the old Acheron of Virgil, the present Fusaro. Over its whole extent are spread, from space to space, great heaps of stones, that have been covered with oysters brought from Tarentum. Round each of these artificial mounds stakes are driven into the ground, tolerably near each other, and projecting from the water, so as to be pulled up easily. Other stakes stand in long rows several feet apart, and are united by ropes, from which bundles of brushwood hang down into the water. All these arrangements are intended to fix the oyster-dust, that annually escapes from the parental shells, and to afford it a vast number of points, to which it may attach itself. After two or three years the microscopic larvæ have grown into edible oysters. Then, at the proper season, the stakes and brushwood bundles are taken out of the water, and after the ripe berries of the marine vineyard have been plucked, again immersed into the lake, until a new generation brings a new harvest. Thus the indolent Neapolitans give us, in this case, an example which the men of the north would do well to imitate; for on many of our coasts numerous localities are to be found where a similar exhibition of industry might convert worthless lagoons and creeks into rich oyster-fields.

PEARL OYSTER AND PEARL FISHING.—“A shell nearly related to the oyster produces the costly pearls of the East, that have ever been as highly esteemed as the diamond itself. The most renowned pearl fishery is carried on in the Bay of Condatchy, in the Island of Ceylon, on banks situated a few miles from the coast. Before the beginning of the fishery, the govern-

ment causes the banks to be explored, and then lets them to the highest bidder, very wisely allowing only a part of them to be fished every year. The fishing begins in February, and ceases by the beginning of April. The boats employed for this purpose assemble in the bay, set off at night at the firing of a signal gun, and reach the banks after sunrise, where fishing goes on till noon, when the sea-breeze, which arises about that time, warns them to return to the bay. As soon as they appear within sight, another gun is fired to inform the anxious owners of their return. Each boat carries twenty men and a chief; ten of them row and hoist up the divers, who are let down by fives — and thus alternately diving and resting, keep their strength to the end of their day's work. The diver, when he is about to plunge, seizes with the toes of his right foot a rope, to which a stone is attached, to accelerate the descent, while the other foot grasps a bag of network. With his right hand he seizes another rope, closes his nostrils with the left, and in this manner rapidly reaches the bottom. He then hangs the net round his neck, and, with much dexterity and all possible despatch, collects as many oysters as he can while he is able to remain under water, which is usually about two minutes. He then resumes his former position, makes a signal to those above by pulling the rope in his right hand, and is immediately by this means hauled up into the boat, leaving the stone to be pulled up afterwards by the rope attached to it. Accustomed from infancy to their work, these divers do not fear descending repeatedly to depths of fifty or sixty feet. They plunge more than fifty times in a morning, and collect each time about a hundred shells. Sometimes, however, the exertion is so great, that, upon being brought into the boat, they discharge blood from their mouth, ears, and nostrils.

"While the fishing goes on, a number of conjurers and priests are assembled on the coast, busily employed in protecting the divers by their incantations against the voracity of the sharks. These are the great terror of the divers, but they have such confidence in the skill or power of their conjurers, that they neglect every other means of defence.

"The divers are paid in money, or receive a part of the oyster-shells in payment. Often, indeed, they try to add to their gains by swallowing here or there a pearl, but the sly merchant knows how to find the stolen property.

"The oysters, when safely landed, are piled up on mats, in places fenced round for the purpose. As soon as the animals are dead, the pearls can easily be sought for and extracted from the gaping shells. After the harvest has been gathered, the largest, thickest, and finest shells, which furnish mother-of-pearl, are sorted, and the remaining heap is left to pollute the air. Some poor Indians, however, often remain for weeks on the spot, stirring the putrid mass in the hopes of gleaning some forgotten pearls from

the heap of rottenness. The pearls are drilled and strung in Ceylon—a work which is performed with admirable dexterity and quickness. For cleaning, rounding, and polishing them, a powder of ground pearls is made use of.

"The Pacific also furnishes these costly ornaments to wealth and beauty; but the pearls of California and Tahiti are less prized than those of the Indian Ocean.

"Pearl-like excrescences likewise form on the inner surface of our oysters and mussels, and originate in the same manner as the true pearls. The formation of the pearl, however, is not yet quite satisfactorily accounted for. Some naturalists believe that the animal accumulates the pearl-like substance to give the shell a greater thickness and solidity in the places where it has been perforated by some annellide or gasteropod. According to Mr. Philippi, an intestinal worm stimulates the exudation of the pearl-like mass, which, on hardening, encloses and renders it harmless.

"Brilliancy, size, and perfect regularity of form are the essential qualities of a beautiful pearl. Their union in a single specimen is rare, but it is of course still more difficult to find a number of pearls, of equal size and beauty, for a costly necklace or a princely tiara."

PECTEN.—The Clam. This valuable mollusk, in its numerous varieties, is too well known to need description. It ranks next to the oyster, and is everywhere highly prized as an article of food. The shores and creeks of all seas supply inexhaustible quantities of clams, which not only furnish the inhabitants with a cheap and nutritious aliment, but are extensively used as bait for cod and other fishes. The fresh-water varieties are not edible.

SONDYLUS.—Like the oyster, these animals have a rough, foliated shell, which, however, is often armed with spines, and is usually beautifully colored, for which reason it is highly valued. The shells often sell at enormous prices, and ornament the cabinets of wealthy amateurs. "A Parisian professor once pawned all his silver spoons and forks to make up the sum of six thousand francs, which was asked for a royal Spondylus; but on returning home, he was so warmly received by his lady, that, overwhelmed by the hurricane, he flung himself on a chair, when the terrific cracking of the box containing his treasure reminded him too late that he had concealed it in his skirt pocket. Fortunately but two of the thorns had been broken off, and the damage was susceptible of being repaired; his despair, however, was so great, that his wife had not the heart to continue her reproaches, and in her turn began to soothe the unfortunate collector."

MYTILUS.—The Mussels. These mollusks have a cloak open in front, but with a separate excremental aperture. They have a foot with which they progress, and fix their byssus. Some of the species are smooth, others are

striated. One curious species, *M. lithophagus*, suspends itself to rocks, like the common mussel, and then perforating it, buries itself in the excavation, and is a prisoner for life.

The common Mussel (*M. edulis*) is found on every coast in extraordinary abundance, and on the Eastern Continent is much used as food. The clam, however, is preferred in this country; but the coast inhabitants of France, Spain, and Great Britain consume enormous quantities of them, and immense numbers are carried into the interior of the country, furnishing an equally cheap and agreeable food; but it is not easy of digestion, and sometimes produces symptoms of poisoning, which have been ascribed to the eggs of asterias, on which it feeds during the summer. In the more northern countries of Europe it is also in great request as a bait for cod, ling, rays, and other large fishes that are caught by the line. Countless millions of mussels are used for this purpose, and in many places they are enclosed in gardens, the ground of which is covered with large stones, to which they attach themselves by their byssus or beard.

"It is a curious fact that the rearing of mussels should have been introduced into France, as far back as the year 1235, by an Irishman of the name of Walton. This man, who had been shipwrecked in the Bay de l'Aiguillon, and gained a precarious living by catching sea-birds, observed that the mussels, which had attached themselves to the poles on which he spread his nets over the shallow waters, were far superior to those that naturally grow in the mud, and immediately made use of his discovery by founding the first *bouchot*, or mussel park, consisting of stakes and rudely-interwoven branches.

"His example soon found imitators, and, strange to say, the method of construction adopted by Walton six centuries ago has been maintained unaltered to the present day. It may give some idea of the immense resources that might be obtained from so many utterly neglected lagoons, when we hear that the fishermen of l'Aiguillon, although they sell three hundred-weight of mussels for the very low sum of five francs, or four shillings, annually export or send them into the interior to the amount of a million or twelve hundred thousand francs."

TRIDACNA. — The animals of this genus have in the front of the shell a large aperture with denticulated margins; for the protrusion of the byssus, which is distinctly tendinous and continuous with the muscular fibres, and in some of them these tendinous fibres, which suspend the animal to rocks, are so hard and tough, that an axe is required to separate them.

T. Gigas. — This species is peculiar to the Indian Ocean, and is famous for its enormous size. The giant clam-shell, which is now to be found in the shop of every dealer in shells, was formerly an object of such rarity and

value, that the Republic of Venice once made a present of one to Francis I., who gave it to the Church of St. Sulpice, in Paris, where it is still made use of as a basin for holy water. The Tridaena attains a diameter of five feet, and a weight of five hundred pounds, the flesh alone weighing thirty.

The muscular power is said to be so great as to be able to cut through a thick rope on closing the shell. It is found in the dead rocks on the coral reefs, where there are no growing lithophytes, except small tufts. Generally only an inch or two in breadth of the ponderous shell is exposed to view, for the Tridaena, like the Pholas, has the power of sinking itself in the rock by removing the lime about it. Without some means like this of security, its habitation would inevitably be destroyed by the roaring breakers. A tuft of byssus, however strong, would be a very imperfect security against the force of the sea for shells weighing from one to five hundred pounds. It is found in the Indian Ocean and the Pacific, as far as the coral zone extends. The animal of the Tridaena, and of the nearly related Bear's-paw (*Hippopus*), distinguishes itself by the beauty of its colors. The mantle of the *Tridacna safranea*, for instance, has a dark-blue edge with emerald-green spots, gradually passing into a light violet. When a large number of these beautiful creatures expand the velvet brilliancy of their costly robes in the transparent waters, no flower-bed on earth can equal them in splendor.

PHOLAS.—The Pholades have two principal valves, wide and ventricose, on the side of the mouth, narrowed and elongated on the opposite side, and leaving at each end a large oblique opening; the foot issues by the opening at the side of the mouth, which is the widest, and from the opposite end there come out the two tubes united in one, and capable of being extended in every direction.

The Pholades secrete a corrosive juice, capable of dissolving calcareous rocks. With the assistance of the secretion, and the action of its sharp-edged valves, the pholas forms a pear-shaped cavern, in which it is condemned to pass its whole life. The thicker part of the body, consisting principally of the very short but strong foot, fills the broad base of the hollow, while the long siphon is turned towards the narrow opening, from which it may be protruded at pleasure. All the movements of the animal are confined to a rising or falling in its narrow prison.

Most of these animals are small, but some species attain a length of five inches. The fragile shell of the pholades seems to have prompted them to seek a better protection in hard stone. They are, consequently, noxious animals; they perforate the walls and calcareous jetties which man opposes to the sea, or raises for the creation of artificial harbors and

landing-places, and destroy their foundations, gradually causing their destruction.

They have an agreeable taste, and in some countries are much used for food.

TEREDO.—The Teredines. This genus is celebrated for its power of destruction. By means of its small rhomboidal valves it excavates wood with great rapidity. It is not much over six inches in length, but in tropical countries there are species of a larger size. "Its shells, which are only a few lines broad, are very small compared with the size of the vermiform body, and are, therefore, completely inadequate for its defence. For better security, it bores deep passages in submerged timber, which it lines with a calcareous secretion, closing the opening with two small lids. Unfortunately, while thus taking care of itself, it causes considerable damage to the works of man. It is principally to guard against the attacks of this worm that ships are sheathed with copper, and the beams of submarine constructions closely studded with nails. During the last century, the Teredo caused such devastations in the dikes which guard a great part of Holland against the encroachments of an overwhelming ocean, that the Dutch began to tremble for their safety; and thus a miserable worm struck terror in the hearts of a nation which had laughed to scorn the tyranny of Philip II., and bade defiance to the legions of the no less infamous Louis XIV."

But while blaming the Teredo for its damages, justice bids us not pass over in silence the services which it renders to man. If it here and there destroys useful constructions, on the other hand, it removes the wrecks that would otherwise obstruct the entrance of rivers and harbors; and we may ask whether these services do not outweigh the harm it causes.

ORDER II. THE SHELL-LESS ACEPHALES.

This is a small order, divided into two families. The first family—*Segregata*—embraces those genera whose individuals are isolated, and without mutual organic connection, although they often live in societies. The most remarkable genus of this family is

SALPA.—The Salpas "have the cloak and its cartilaginous envelope oval or cylindrical, and open at the two extremities. On the side of the anus the aperture is transverse, wide, and furnished with a valve, which allows the water to enter, but prevents its egress; on the side of the mouth the aperture is simply tubular. Muscular bands embrace the cloak and contract the body. The animal moves by forcing out from the anterior aperture

the water which has entered the body by the posterior, so that its motion is always retrograde, whence it has happened that some naturalists have mistaken the posterior aperture for the real mouth. It also generally swims with the back undermost. The cloak and its envelope exhibit in the sun the colors of the rainbow, and are so transparent that the whole structure of the animal can be seen through them: in many they are furnished with perforated tubercles. The animal has been seen to come out from its envelope without apparently any injury. But a more curious fact in their history is that, during a certain period, they remain united together, as they were in the ovary, and float in the sea in long chains, the individuals being disposed, however, in a pattern different in different species. M. de Chamisso assures us that he has ascertained a still more singular fact, which is, that the individuals that have issued from a multiplicate ovary have not an ovary of the same kind, but produce only isolated individuals of a form considerably different from their originals; and these, again, give birth to others with ovaries similar to the parents of the first, so that there is, alternately, a scanty generation of separated individuals, and a numerous generation of aggregated individuals, and these two alternating generations do not resemble each other. These animals are found in abundance in the Mediterranean and the warmer portions of the ocean, and are frequently phosphorescent."

The second family—*Aggregata*—of this order is composed of animals united in a common mass, so that they seem to communicate organically with each other. This union, however, does not take place in the early stages of their existence, but at a later period.

BOTRYLLUS.—The Botrylli have an oval form, adherent to various foreign bodies, and are united by tens or twenties, like the rays of a star. They form gelatinous crusts bespangled with stars on the leaves of algae. Every star-ray is the body of one of the individuals of which the extraordinary colony is composed; and in the centre lies the common intestinal orifice.

PYROSOMA.—The Pyrosomæ unite in great numbers, so as to form a large hollow cylinder, open at one end and closed at the other, which swims in the ocean by the alternate contraction and expansion of the individual animals composing it. They sparkle during the night with all the brilliancy of phosphorus.

The two remaining classes of this division,—the *Brachiopods*, or arm-footers, and *Cirrhopods*, or beard-footers, have nothing interesting to offer, and we therefore pass them by without further notice.

THIRD DIVISION. ARTICULATED ANIMALS.

THE Articulata have no internal skeleton, the articulated rings which surround the body, and usually the limbs, in some measure supplying its place. In the Annelides these rings are nearly the sole means of locomotion, as they have merely a soft and membranous body. The term *articulated* signifies *jointed*, and the division embraces those animals, the various pieces of whose bodies are joined together by muscles or flexible membranes. Some of the families have a soft, membranous body, like the common earth-worm, and others have a hard, bony covering, like the lobster. There are four classes: 1st. The ANNELEIDES, or *Red-blooded Worms*; 2d. The CRUSTACEANS, or *Lobsters* and *Crabs*; 3d. The ARACINIDES, or *Spiders*; and 4th. INSECTA, embracing more species than any other class of the animal kingdom.

CLASS I. THE ANNELEIDES.

The class of the Annelides, or annulated worms, to which also our common earth-worm and the leech belong, peoples the seas with by far the greater number of its genera and species. All of them are distinguished by an elongated and generally worm-like form of body, susceptible of great extension and contraction. The body consists of a series of rings, or segments, joined by a common elastic skin; and each ring, with the exception of the first or foremost, which forms the head, and the last, which constitutes the tail, exactly resembles the others, only that the rings in the middle part of the body are larger than those at the extremities. The head is frequently provided with eyes, and more or less perfect feelers; the mouth is armed, in many species, with strong jaws, or incisive teeth. The blood is red, and circulates in a system of arteries and veins.

We are accustomed to associate with the idea of a worm all sorts of disgusting and revolting impressions; and yet an examination of many of the Aquatic Annelides will show us that it is not without some reason that M. De Quatrefages remarks, —

"Talk no more of the violet as the emblem of modesty. Look rather at our Annelides, that, possessed of every shining quality, hide themselves

from our view, so that but few know of the secret wonders that are hidden under the tufts of algae, or on the sandy bottom of the sea."

And if we look to outward appearance, we shall find that many of the marine Annelides may well be reckoned among the handsomest of creatures. They display the rainbow tints of the humming-birds, and the velvet, metallic brilliancy of the most lustrous beetles. The vagrant species that glide, serpent-like, through the crevices of the submarine rocks, or, half creeping, half swimming, conceal themselves in the sand or mud, are pre-eminently beautiful. The delighted naturalists have consequently given them the most flattering and charming names of Greek mythology—*Nereis*, *Euphrosyne*, *Eunice*, *Alciope*, &c.

In the most of the wandering Annelides, each segment is provided with variously-formed appendages, more or less developed, serving for respiration and locomotion, or for aggression and defence; while in some of the least perfect of the class, not a trace of an external organ is to be found over the whole body. Almost all of them, however, feed on a living prey,—*Planarias* and other minute creatures,—which they enclasp and transpierce with their formidable weapons. Some, lying in wait, dart upon their victims as they heedlessly swim by, seize them with their jaws, and stifle them in their deadly embrace; others, of a more lively nature, seek them among the thickets of corallines, millepores, and algae, and arrest them quickly ere they can vanish in the sand.

But the Annelides also are liable to many persecutions. The fishes are perpetually at war with them; and when an imprudent Annelide quits its hidden lurking-place, or is uncovered by the motion of the waves, it may reckon itself fortunate, indeed, if it escapes the greedy teeth of an eel or a flat-fish. It is even affirmed of the latter, as it is of the whelks, that they know perfectly well how to dig the Annelides out of the sand. The sea-spiders, lobsters, and other crustacea are the more dangerous, as their hard shells render them perfectly invulnerable by the bristling weapons of the Annelides.

ORDER I. TUBICOLÆ.

While the greater part of these worms lead a vagrant life, others, like secluded hermits, dwell in self-constructed retreats, which they never leave. Their cells, which they begin to form very soon after having left the egg, and which they afterwards continue extending and widening, according to the exigencies of their growth, generally consists of a hard, calcareous mass; but sometimes they are leathery or parchment-like tubes, secreted by the skin of the animal, not, however, forming, as in the mollusks, an in-

tegral part of the body, but remaining quite unconnected with it. Thus these *tubicole* Annelides spend their whole life within doors, only now and then peeping out of their prison with the front part of their head.

As they lead so different a life from their roaming relations, their internal structure is very different. Thus we find here no bristling feet or lateral respiratory appendages; but, instead of these organs, which in this case would be completely useless, we find the head surmounted by a beautiful crown of feathery tentacula, which equally serve for breathing and the seizing of a passing prey. Completely closed at the inferior extremity, the tube shows us at its upper end a round opening, the only window through which our hermit can peep into the world, seize his food, and refresh his blood by exposing his floating branchiaæ to the vivifying influence of the water.

"Do not, therefore, reproach him with vanity or curiosity if you see him so often protrude his magnificently decorated head; but rejoice rather that this habit, to which necessity obliges him, gives you a better opportunity for closer observation. Place only a shell or stone, covered with serpulas or cymospiras, in a vessel filled with sea-water, and you will soon see how, in every tube, a small round cover is cautiously raised, which hitherto hermetically closed the entrance, and prevented you from prying into the interior. The door is open, and soon the inmate makes his appearance. You now perceive small buds, here dark violet or carmine, there blue or orange, or variously striped. See how they grow, and gradually expand their splendid boughs! They are true flowers that open before your eye, but flowers much more perfect than those which adorn your garden, as they are endowed with voluntary motion and animal life.

"At the least shock, at the least vibration of the water, the splendid tufts contract, vanish with the rapidity of lightning, and hide themselves in their stony dwellings, where, under cover of the protecting lid, they bid defiance to their enemies."

Not all the tubicole Annelides form grottos or houses of so complete a structure as those I have just described. Many content themselves with agglutinating sand or small shell fragments into the form of cylindrical tubes. But even in these inferior architectural labors of the Sabellas, Terebellas, Amphitrites, &c., we find an astonishing regularity and art; for these elegant little tubes, which we may often pick up on the strand, where they lie mixed with the shells and algæ cast out by the flood, consist of particles of almost equal size, so artistically glued together, that the delicate walls have everywhere an equal thickness. The form is cylindrical, or funnel-shaped, the tube gradually widening from the lower to the upper end.

Some of these tubic平les live like solitary hermits, others love company; for instance, the *Sabella alveolaris*, which often covers wide surfaces of rock near low-water mark with its aggregated tubes. When the flood recedes, nothing is seen but the closed orifices; but when covered with the rising waters, the sandy surface transforms itself into a beautiful picture. From each aperture stretches forth a neck ornamented with concentric rings of golden hair, and terminating in a head embellished with a tiara of delicately-feathered, rainbow-tinted tentacula. The whole looks like a garden-bed enamelled with gay flowers of elegant forms and variegated colors.

The principal genera are *Serpula*, *Sabella*, *Terebella*, *Amphitrite*, *Syphostoma*, and *Dentalium*.

ORDER II. THE DORSIBRANCHIATA.

This order comprises those *Annelides* which have their gills distributed throughout the whole length of the body. It is divided into twenty-four genera. These are, for the most part, creatures of wonderful structure; and as our space will not allow us to refer to them all, we will introduce two of the groups which, we think, will serve best to represent the whole.

GENUS EUNICE.—These animals are furnished with tuft-like gills, and the trunk is strongly armed with three pairs of horny jaws, while each of their feet has two cirri and a bundle of bristles.

With the idea of worms we generally connect the notion of incompleteness; we are apt to consider them as beings equally uninteresting and ugly, and disdain to inquire into the wonders of their organization. But a cursory examination of the *Eunice gigantea*, a worm about two and a half feet long, and frequently occurring on our coasts, would alone suffice to give us a very different opinion of these despised, but far from despicable creatures. The whole body is divided into segments scarce a line and a half long, and ten or twelve lines broad, and thus consists of about three hundred rings, a brain, and three hundred ganglions, from which about three thousand nervous branches proceed, regulate the movements, sensations, and vegetative functions of a EUNICE. *Two hundred and eighty stomachs digest its food; five hundred and fifty branchiae refresh its blood; six hundred hearts distribute this vital fluid throughout the whole body, and thirty thousand muscles obey the will of the worm, and execute its snake-like movements.* Surely an astonishing profusion of organs!

HALITHEA.—This animal has three leaflets in its branchiae, between two of which is a very small crest: it has no jaws. There is one species—*Aphiodita aculeata*, Linn.—quite common, which is among the most beau-

tifully colored of animals. "Its form is oval, six or eight inches long, and two or three broad. The scales of its back are covered and concealed by a substance resembling tow, which originates at its sides : the latter have also groups of stout spines, which partly pierce the tongue, together with bundles of flexible bristles, as brilliant as gold, and changeable to every hue of the rainbow. The colors they present are surpassed in beauty neither by the scale-like feathers of the humming-bird, nor by the most brilliant gems. Below them is a tubercle bearing three groups of spines, of three different thicknesses, and finally a fleshy cover. There are forty of these tubercles on each side, and between the two first are two little fleshy tentacles ; besides which there are fifteen pairs of broad scales, which are sometimes bulged upon the back, and fifteen small branchial crests on each side.

"The animals of this group, which greatly resemble, in form, the *Euphrosine laureata*, are well known under the name of Sea Mice, and are often thrown upon the beach after a gale of wind. In some species the lateral setæ exhibit a beautiful structure, admirably fitting them for weapons of defence, being barbed on each side at the tip ; but, in order to prevent the injury which might occur to the animal in consequence of the power it possesses of retracting these setæ, each is enclosed in a smooth, horny sheath, composed of two blades."

ORDER III. ABRANCHIA.

These Annelides have no respiratory organs appearing externally, and seem to breathe either, as in the earth-worms, over the whole surface of the skin, or, as in the leeches, by internal cavities. Some have bristles, which serve for locomotion, and others are not thus furnished ; and from this peculiarity they are divided into two families — the *Bristled* and the *Unbristled*.

FIRST FAMILY.—This comprises the Earth-worms, or Nereides of Linnaeus ; they are provided with silky bristles, have a long, cylindrical body divided by transverse furrows into a great number of rings, and a mouth without teeth. The genus

LUMBRICUS may be regarded as a fair representative of the whole family. *L. terrestris*, the common Earth-worm, is a well-known species, which often attains to quite a foot in length, with one hundred and twenty rings. There are two pores under the sixteenth ring, the purpose of which has not been discovered. It mines the ground in all directions, piercing it with great ease, in search of the roots and animals on which it subsists. In the month of June it seeks the upper world at night, and searches for a com-

panion. "It is especially in rich and well-manured soils that the Earth-worm delights, particularly in gardens and meadows; they are extremely sensitive to movements of the earth; and anglers, knowing well their temerity in this respect, take advantage of it, in order to obtain a supply of these animals for baits, by introducing a spade or fork into the ground, and stirring the soil, when they soon appear on the surface. We are indebted to Charles Darwin, Esq., for a remarkable and interesting memoir on the utility of this animal, read before the Geological Society of London. The worm casts, which so much annoy the gardener by deforming his smooth-shaven lawns, are of no small importance to the agriculturist; and this despised creature is not only of great service in loosening the earth, and rendering it permeable by air and water, but is also a most active and powerful agent in *adding to the depth of the soil*, and in covering comparatively barren tracts with a superficial layer of wholesome mould. The author's attention was directed by Mr. Wedgwood, of Maer Hall, Staffordshire, to several fields, some of which had, a few years before, been covered with lime, and others with burnt marl and cinders, which substances in every case are now buried to the depth of some inches below the turf, just as if, as the farmers believe, the particles had worked themselves down. After showing the impossibility of this supposed operation, the author affirms that the whole is due to the digestive process by which the common Earth-worm is supported, since, on carefully examining between the blades of grass in the fields above mentioned, he found that there was scarcely a space of two inches square without a little heap of the cylindrical castings of worms; it being well known that worms swallow earthy matter, and that, having separated the serviceable portion, they eject at the mouth of their burrows the remainder in little intestine-shaped heaps. Still more recently Mr. Darwin has noticed a more remarkable instance of this kind, in which, in the course of eighty years, the Earth-worms had covered a field, then manured with marl, with a bed of earth, averaging thirteen inches in thickness."

SECOND FAMILY.—This comprises the *unbristled* or smooth animals. There are two genera, and numerous species, all which are aquatic.

HIRUDO.—The Leeches have an oblong body, sometimes depressed and wrinkled transversely, the mouth encircled by a lip, and the posterior extremity furnished with a flattened disk, both ends being adapted to fix upon bodies by a kind of suction, by means of which these animals move; for, having fixed their anterior extremity, they draw the other up to it, and fix that, and then re-advance the first; besides which, they swim with facility. Several have a double series of pores underneath the body, which are the orifices of little internal pouches, considered by some naturalists as

organs of respiration, although they are generally filled with a mucous fluid. The intestinal canal is straight and swollen at intervals, extending for two thirds the length of the body, where there are true cœca. The blood they swallow continues red, and without alteration for several weeks. The ganglia of their nervous system are much more separated than those of the earth-worms. They are hermaphrodite; and several accumulate their eggs into cocoons enveloped by a fibrous excretion.

On opening the Leech shortly after it has gorged itself with the blood of its prey, it will be found that none of the blood has passed into the intestines. The operation of digestion is extremely slow, notwithstanding the rapid and excessive manner in which the Leech fills its stomach: a single meal of blood will suffice for many months; nay, more than a year will sometimes elapse before the blood has passed through the intestines in the ordinary manner, during all which period so much of the blood as remains undigested in the stomach continues in a fluid state, and as if just taken in, notwithstanding the vast difference in the heat of the body of a mammiferous animal and that of a Leech.

From differences discovered in the organization of the mouth, several subgenera have been established, of which the following deserve a brief notice:—

SANGUISUGA.—This is the Leech (*H. medicinalis*, Linn.) so well known in pharmacy as an instrument for local blood-letting.

GORDIUS.—The hair-worms so often seen floating in the water belong to this group, and also the great Band-worm (*Nemertes gigas*)—a very singular animal, which has many of the characteristics of the Entozoa. It is from thirty to forty feet long, about half an inch broad, flat like a ribbon, of brown or violet color, and smooth and shining like lacquered leather. Among the loose stones, or in the hollows of the rocks, where it principally lives on Anomiæ,—minute shells that attach themselves to submarine bodies,—this giant worm forms a thousand seemingly inextricable knots, which it is continually unravelling and tying. When, after having devoured all the food within its reach, or from other cause, it desires to shift its quarters, it stretches out a long, dark-colored ribbon, surmounted by a head like that of a snake, but without its wide mouth or dangerous fangs. The eye of the observer sees no contraction of the muscles, no apparent cause or instrument of locomotion; but the microscope teaches us that the Nemertes glides along by help of the minute vibratory ciliae with which its whole body is covered. It hesitates, it tries here and there, until at last, and often at a distance of fifteen or twenty feet, it finds a stone to its taste; whereupon it slowly unrolls its length to convey itself to its new resting-place; and while the entangled folds are unravelling themselves at one end,

they form a new Gordian knot at the other. All the organs of this worm are uncommonly simplified; the mouth is a scarce visible circular opening, and the intestinal canal ends in a blind sac.

CLASS II. CRUSTACEA.

This large class is divided by modern naturalists into two families—the *Malacostraca* and *Entomostraca*. The first is distinguished by a solid, calcareous covering; ten or fourteen legs, with hooked tips; mouth placed in the ordinary situation; eyes, in most species, supported on a movable foot-stock, articulated at its base; and branchiae or gills, which are hidden beneath the lateral margins of the shell; in some, however, they are placed beneath the abdomen. This section is separated into five orders, founded on differences in the situation and character of the feet, viz., 1. *Decapoda*; 2. *Stomapoda*; 3. *Laemodipoda*; 4. *Amphipoda*, and, 5. *Isopoda*.

The second section (*Entomostraca*) comprises the genus *Monoculus* of Linnaeus, or the Shell-insects of Muller. "The envelope is corneous, very slender, and the body in the majority is covered by a shell, composed of two pieces, not unlike that of the bivalve Mollusca. The eyes are ordinarily sessile, and often there is but one of these organs. The legs, of which the number varies, are, in the majority, fitted only for swimming, without any terminal hook. Some of them are most nearly allied to the preceding groups by having the mouth anteriorly situated, and composed of a labrum, two mandibles (rarely palpigerous), a tongue, and at most two pair of maxillæ, the outer ones not being covered by foot-jaws. In the others, which appear to approach the Arachnida in many respects, the organs of mastication sometimes merely consist of the coxae of the legs, advanced and lobe-like, armed with numerous small spines, and surrounding a large central pharynx; whilst in others they form a small siphon or beak, used as a sucker, as in many Arachnida and insects; and even sometimes they are not, or scarcely, visible on the exterior of the body, the siphon itself being either internal, or the action of suction being performed by a kind of sucking-cup."

The Crustacea—lobsters, crabs, shrimps—were reckoned by Linnaeus, along with the centipedes and spiders, among insects; but they differ so much from them all, and are so important from their great numbers, that modern naturalists have raised them to the dignity of a separate class. They have, indeed, in common with insects, an annular type of body, covered more or less with a hard crust; are, like them, provided with tentacula or feelers, and similarly-formed organs of mastication; but insects breathe atmospheric air through lateral pores and tracheæ, while the Crustaceans, with the

exception of the land Onisci, respire in the water. The perfect insect undergoes no further change; the Crustacean, on the contrary, increases in size with every successive year. The Crustacean possesses a heart, which propels the blood after it has been aerated in the gills; in the insect the circulation of the blood is by no means so highly organized. No insect has more than six legs, no Crustacean less than ten.

The centipedes respire air like the insects, and are distinguished by their elongated form of body, and the great number of their legs, far surpassing, in this respect, the most richly-endowed Crustacean.

Spiders, and particularly scorpions, have undoubtedly the greatest outward resemblance to the Crustaceans; but all spiders have only eight legs, and are generally provided with eight eyes; while the Crustaceans have only two of these organs of vision, which, in the higher species, are generally fixed on stalks. The claws of the crab or lobster are properly fore feet, and serve for creeping, or the seizure of prey; while the claws of the scorpion are nothing but peculiarly-formed feelers, which do not in the least contribute to locomotion. Besides, the scorpion inhabits the dry land, while the Crustacea, with the exception of a few species that dwell in humid places, inhabit brooks and rivers, but principally the ocean, where their legions are found along the coasts, or people, far from any land, the deserts of the high seas.

The respiratory apparatus of the Crustaceans exhibits many interesting particulars. In some of the lower orders it is seated in the legs, whose extremely thin and delicate teguments allow the complete aeration of the blood. To move and to breathe are with these nimble animals one and the same thing. In others the branchiae appear in the form of floating feathery plumes, or as membranous vesicles attached to the basis of the fore feet. In the most developed Crustaceans, finally, the crabs and lobsters, they are enclosed in two chambers, situated one at each side of the under surface of the carapace, or broad, shelly plate, which covers the back of the animal. Each of these chambers is provided with two openings, one in the front, near the jaws, the other behind. In the long-tailed species, the posterior opening is a wide slit at the basis of the feet; in the short-tailed kinds, a small, transverse aperture before the first pair of feet. By means of this formation the short-tailed crabs, like those fishes that are provided with a narrow opening to their gill-covers, are enabled to exist much longer out of the water than the long-tailed lobsters. Some of them even spend most of their time on land, and, still better to adapt them for a terrestrial life, the internal surfaces of the branchial caverns are lined with a spongy texture, and the gill-branches separated from each other by hard partitions, so

as to prevent them from collapsing after a long penury of water, and thus completely stopping the circulation.

While in fishes the water that serves for respiration flows from the front backward, so as not to impede their motions, the stream of water traversing the gill of the Crustaceans is made to flow from behind forward, and thus harmonizes perfectly with their retrograde movements. So wonderfully has the anatomical structure of these animals, like that of all other living things, been suited to their peculiar mode of life.

All Crustaceans, however different their external aspect may be, are formed according to the same plan or fundamental idea. Among the lower orders the body consists of a number of almost equal-sized rings, each furnished with a pair of crawling or swimming legs. But as we ascend in the scale, we find the rings coalescing more or less to larger pieces, particularly in the crabs, whose broad, chalky carapace indicates its compound nature only by the number of pairs of legs which rise from its lower surface.

ORDER I. DECAPODA (Ten-footed).

The animals of this order have a shell or covering, which envelops the body, limbs, and head, the latter of which is fixed compactly to the thorax. They are slow of growth, and of long life. Some of the species attain the length of a foot. "Their claws, as is well known, are extremely powerful. They ordinarily reside in the water, but are not immediately killed by being removed into the air: indeed, some species pass a considerable part of their existence out of the water, which they only seek in order to deposit their eggs in it. They are, nevertheless, compelled to reside in damp situations and burrows. They are naturally voracious and carnivorous: some species, indeed, are said to frequent the cemeteries in order to feed upon dead bodies. Their limbs are renewed, when injured, with great quickness; but it is necessary that the fracture should have been made at the junction of the joints: they, however, have the instinct to effect this if the wound has been of a different nature. When desirous to change their skins, they seek for some retired spot, where they may be at rest and secure from their enemies. The moulting then takes place, the body being at first soft and of a delicate flavor, as in the case of the Black Crab of the West Indies, which is kept in cages expressly for the table. The chemical analysis of the old shell proves that it is formed of carbonate of lime and phosphate of lime in different proportions. By the action of the heat the epidermis assumes a bright-red color, the coloring principle being decomposed by the action of boiling water."

The order is divided into two families — *Brachyura* (Short Tails), and *Macrura* (Long Tails). The first comprises the genus

CANCER. — The Crabs. The distinguishing characteristics of the genus are, the tail shorter than the thorax, triangular in the male, and rounded in the female; small antennae; the peduncles of the eyes larger than in the second family; and branchiae arranged in a single row in pyramidal plates, composed of a great number of minute leaflets spread one upon the other.

Crabs are completely wanting in the high northern seas; their number increases with the warmer temperature of the waters, and attains its maximum in the tropical zone. Here we find the most remarkable and various forms; here they attain a size unknown in our seas; and here they do not, as with us, inhabit solely the salt waters, but also people the brooks and rivers, or even constantly sojourn on land; as, for instance, the Thelphusæ and Geocarcini. There are even some species of land crabs that suffocate when dipped into water. They breathe, indeed, through branchiae, but the small quantity of oxygen dissolved in water does not suffice for the wants of their active respiration. They generally live in the shades of the damp forests, often at a great distance from the sea, concealing themselves in holes. At breeding-time they generally seek the shore for the purpose of washing off their spawn, and depositing it in the sand; and no obstruction will then make them deviate from the straight path.

They feed on vegetable substances, and are reckoned very excellent food. When taken, they will seize the person's finger with their claw, and endeavor to escape, leaving the claw behind, which, for some time after it has been separated from the body, continues to give the finger a friendly squeeze. In the dusk of the evening they quit their holes, and may then be seen running about with great swiftness.

C. Pagurus. — This is the common edible crab. It has a very broad shell, and arched for a great distance along the sides; the claws are large, and the fingers are black, armed with obtuse points. It is captured by sinking pots or baskets, properly prepared and baited, to a considerable depth in the ocean along the rocky coast. It is the most abundant in the summer. At low tide these crabs are found among the rocks in pairs, and if the male be taken away, another will be found in its place at the next recess of the tide. In winter they either burrow in the sand or withdraw to deeper waters.

PORTUNAS. — The Portuni have the ordinary crab-like form, but the ocular peduncles are very short, and the terminal joint of the hind legs is much narrower than in the Paguri. They are abundant in the Venetian lagoons, and the catching of them affords a profitable employment to the inhabitants of those swampy regions. Whole cargoes are sent to Istria, where they are

used for bait for anchovies. The fishermen gather them in a short time before they cast their shell, and preserve them in baskets until the moulting process has been effected, when they are reckoned a delicacy even on the best tables. On attempting to seize this crab, it runs rapidly sidewise, and conceals itself in the mud; but when unsuccessful, it raises itself with a menacing mien, beats its claws noisily together, as if in defiance of the enemy, and prepares for a valiant defence, like a true knight.

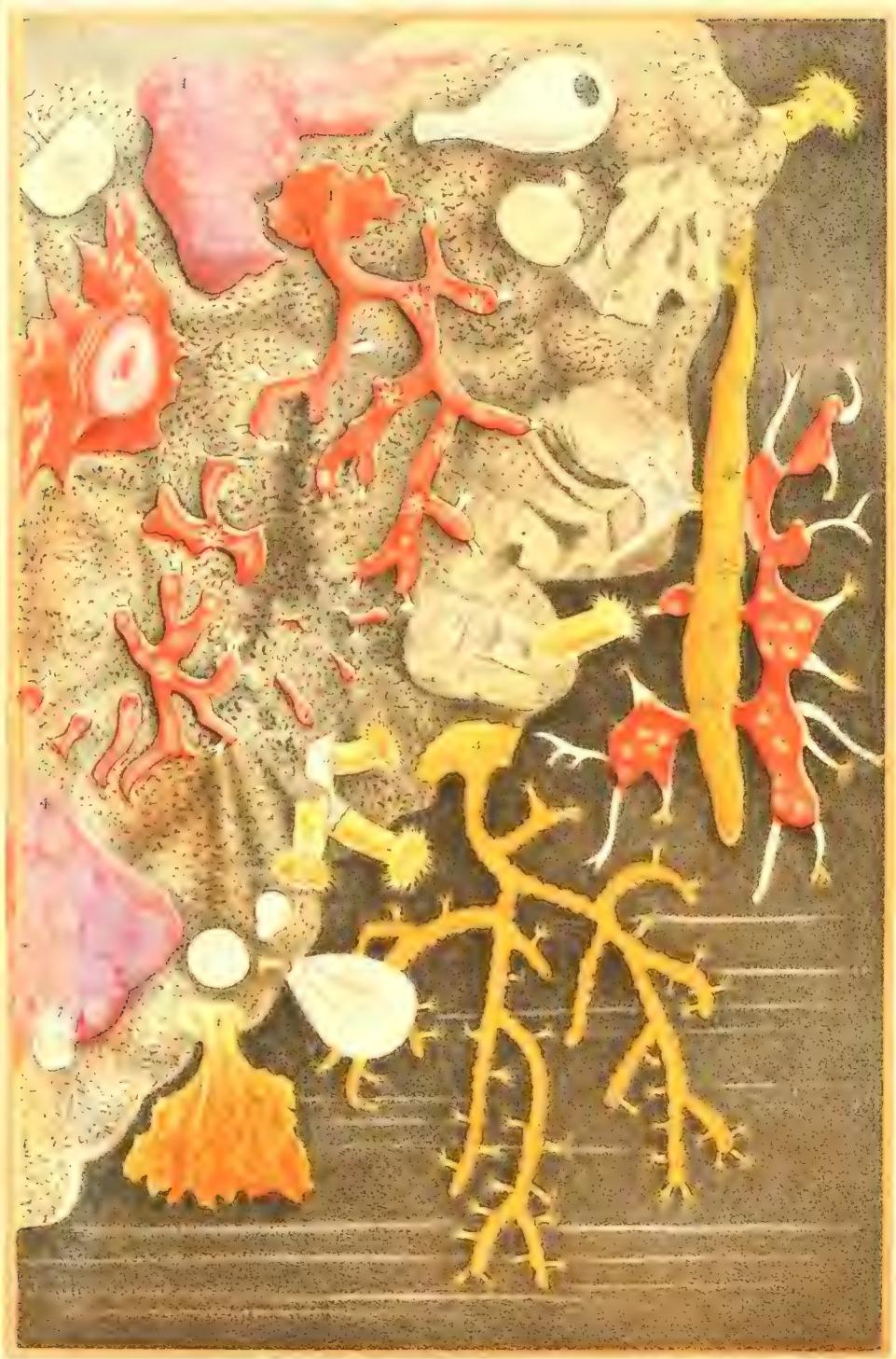
The legs of the crabs are very differently formed in various species. In those which have been called sea-spiders they are very long, thin, and weak, so that the animal swims badly, and is a slow and uncertain pedestrian. For greater security, it therefore generally seeks a greater depth, where, concealed among the sea-weeds, it wages war with annelides, planaries, and small mollusks. Sea-spiders are often found on the oyster banks, and considered injurious by the fishermen, who unmercifully destroy them whenever they get hold of them.

In other species the legs are short, muscular, and powerful, so as rapidly to carry along the comparatively light body. The tropical land-crabs and the genera *ocypoda* and *grapsus*, which form the link between the former and the real sea-crabs, are particularly distinguished in this respect.

The rider or racer (*Ocypoda cursor*), which is found on the coasts of Syria and Barbary, and abounds at Cape de Verde, owes its name to its swiftness, which is such that even a man on horseback is said not to be able to overtake it. The West Indian *ocypodas* dig holes three or four feet deep, immediately above high-water mark, and leave them after dusk. Towards the end of October they retire farther inland, and bury themselves for the winter in similar holes, the openings of which they carefully conceal.

A strange peculiarity of many crabs is the quantity of parasites they carry along with them on their backs. Many marine productions, both of a vegetable and animal nature, have their birth and grow to beauty on the shell of the sea-spider. Corallines, sponges, zoophytes, algae, may thus be found, and balani occasionally cover the entire upper surface of the body of the crab. "All the examples of the *Inachus Dorsettensis* which I have taken," says the distinguished naturalist Mr. W. Thomson, of Belfast, "were invested with sponge, which generally covers over the body, arms, and legs; algae and zoophytes likewise spring from it." In this extraneous matter some of the smaller zoophytes find shelter, and, together with the other objects, render the capture of the *Inachus Dorsettensis* interesting far beyond its own acquisition. In Mr. Hyndman's collection there is a sea-spider carrying on its back an oyster larger than itself, and covered besides with numerous barnacles.

THELPHUSA.—The Thelphusæ have the ocular peduncles longer than



CORALS.

A Piece of Macciotta fished up from 80 fathoms depth in the neighbourhood of Calle

- 5 BALANOPHYLLIA ITALICA
- 6 FLABELLUM ANTHOPHYLLUM
- 7 THECIDIA MEDITERRANEA
- 6 TEREBRATULUM CARUT SERPENT

1
2
3
4
5
6
7

the lateral antennæ. The shell is nearly of a cordate truncate form. There are several species of this genus which reside in fresh water, but being able to exist for a considerable time out of their native element; one noticed by the ancients occurs in the south of Europe; it is the *Cancer fluvialis* (Belon.). It is often represented upon the ancient Greek medals. The Greek monks eat it uncooked, and it forms a common article of food in Italy during Lent. Delalande and De Latour discovered two other species, one in the south of Africa, and the other in the mountains of Ceylon. There is another species, *Thelphusa cunicularis*, discovered by Colonel Sykes, in the ghauts of the Deccan, where it occurs in great abundance, and of which Bishop Heber thus speaks in his Journal: "All the grass through the Deccan generally swarms with a small land-crab, which burrows in the ground, and runs with considerable swiftness, even when encumbered with a bundle of food as big as itself: this food is grass, or the green stalks of rice; and it is amusing to see the crabs sitting, as it were, upright, to cut their hay with their sharp pincers, and then waddling off with their sheaf to their holes as quickly as their sidelong pace will carry them." Colonel Sykes found them on the table-lands at an elevation of nearly four thousand feet above the sea; and as they are met with of all sizes, he believes that their productive process is completed without the crab having to undertake any annual journey to the sea, their migrations having never been noticed. To this section also belong other species of land-crabs, composing the genera *Gelasimus ocy-poda* and *mictyris*. The first of these genera has the carapax solid, and nearly quadrilateral, but rather broader in front; one of the claws is generally much longer than the other, the fingers of the smaller claws being spoon-shaped. The animal closes the mouth of its burrow, which it makes near the shore, with its larger claw. These burrows are cylindrical, oblique, and very deep, each having a single inhabitant. It is the habit of this crab to hold up the large claw in the front of the body, as though beckoning to some one; whence they have obtained the name of Calling Crabs. The species of *Ocypoda* has the eyes extended along the greater length of the foot-stalks. Their claws are also unequal, but not to the same extent as in the *Gelasimi*. During the day they sit in their burrows, venturing forth only after sunset. The type *Cancer cursor* (Linn.) inhabits Syria and Northern Africa. Other species of land-crabs are of a truncate cordate form, with the shell rounded and dilated at the sides. They inhabit tropical climates, and are called by the inhabitants painted crabs, land crabs, violet crabs, &c., which names seem to be applied indiscriminately. There are few travellers who have not mentioned their habits, often mixing up much fiction in their accounts. They pass the greater part of their lives in the earth, hiding themselves by day and coming abroad only at night.

Sometimes they frequent cemeteries. Once a year, as the period for depositing their eggs draws near, they assemble in numerous companies, and, following the most direct line, seek the coast without permitting any obstacle to intercept them in their way. After laying their eggs in the water, they return, greatly enfeebled. It is said that they close the mouth of their burrows at the period of moulting; after which operation, and whilst still soft, they are reckoned a great delicacy.

Another interesting group constitutes the genus *Pinnotheres* (Latr.). These are of very small size, of which there are several species, named pea-crabs, and which reside, during a portion of the year at least, inside various bivalve shells, such as mussels, &c. The carapax of the females is suborbicular, very thin and soft, whilst that of the males is firmer and nearly globular, and rather pointed in front; the legs are of moderate length, and the claws of the ordinary form; the tail of the female is very ample, and covers the whole of the under side of the body. The ancients believed that the pea-crabs lived upon the best terms with the inhabitants of the shells in which they were found, and that they not only warned them of danger, but went abroad to cater for them.

SECOND FAMILY OF DECAPODA, MACRURA. — In the genera composing this family, the tail and antennæ are much longer than in the former, and the shell is narrower and more elongate. With few exceptions the *Macrura* are all marine animals, and never quit the water.

BIRGUS. — This genus appears to be a connecting link between the short and long tailed crabs. On account of their large size, the solidity of their integuments, and the form of the tail, these crabs are not able to lodge in shells, but must retire to crevices in the rocks, or hide themselves in burrows in the earth.

B. Catro. — This species is of a large size, and inhabits the Isle of France, where it is called the Purse Crab. It is said to climb the palm-trees for the sake of detaching the heavy nuts; but Mr. Darwin, who attentively observed the animal on the Keeling Islands, tells us that it merely lives upon those that spontaneously fall from the tree. To extract its nourishment from the hard case, it shows an ingenuity which is one of the most wonderful instances of animal instinct. It must first of all be remarked, that its front pair of legs is terminated by very strong and heavy pincers, the last pair by others narrow and weak. After having selected a nut fit for its dinner, the crab begins its operations by tearing the husk, fibre by fibre, from that end under which the three eye-holes are situated; it then hammers upon one of them with its heavy claws until an opening is made. Hereupon it turns round, and, by the aid of its posterior pincers, extracts the white, albuminous substance. It inhabits deep burrows, where it accumulates surprising quantities of

picked fibres of cocoa-nut husks, on which it rests as on a bed. Its habits are diurnal; but every night it is said to pay a visit to the sea, no doubt for the purpose of moistening its branchiæ. It is very good to eat, living as it does on choice vegetable substances; and the great mass of fat accumulated under the tail of the larger ones sometimes yields, when melted, as much as a quart of limpid oil.

PAGURUS. — The Hermit Crabs. The Pagurians have the four hind legs much smaller than the preceding. The tail is long, soft, and narrowed at the tip. As Nature has provided them with no sufficient covering or protection, they have "to look about them for some shelter; and this is afforded them by several conchiform shells, *buccina*, *nerite*, in which they so tenaciously insert their hooked tails, as if both were grown together. So long as they are young and feeble, they content themselves with such shells as they find empty on the strand; but when grown to maturity, they attack living specimens, seize with their sharp claws the snail, ere it can withdraw into its shell, and, after devouring its flesh, creep, without ceremony, into the conquered dwelling, which fits them like a coat when they take a walk, and the mouth of which they close, when at rest, with their largest forceps, in the same manner as the original possessor used his operculum or lid. How remarkable that an animal should thus find in another creature, belonging to a totally different class, the completion, as it were, of its being, and be indebted to it for the protecting cover which its own skin is unable to secrete!

"When the dwelling of the Pagurus becomes inconveniently narrow, the remedy is easy, for appropriate sea-shells abound wherever hermit crabs exist. They are found on almost every coast, and every new scientific voyage makes us acquainted with new species. According to Quoy and Gaimard, they are particularly numerous at the Ladrones, New Guinea, and Timor. The strand of the small Island of Kewa, in Coupang Bay, was entirely covered with them. In the heat of the day they seek the shade of the bushes; but as soon as the cool of evening approaches, they come forth by thousands. Although they make all large snail-houses answer their purposes, they seem in this locality to prefer the large Sea Nerites."

The manœuvres of several species, when they have outgrown their habitation, are quite ludicrous. Crawling slowly along the line of empty shells thrown up by the last wave, and unwilling to part with their now incommodious domicile until another is obtained, they carefully examine, one by one, the shells that lie in their way, slipping their tails out of the old house into the new one, and again betaking themselves to the old one, should not this fit. In this manner they proceed until they have found a home to their liking.

ASTACUS.—This genus is distinguished by having the lateral plates of the swimmerets broad and rounded at the extremity. The two filaments of the intermediate antennæ are longer than their peduncles.

A. Marinus.—The Lobster. This valuable crustacean, which is celebrated everywhere for the delicacy of its flesh, is, in this country, an article of extensive trade. Many millions are taken annually along our coasts, and distributed by railroad, packed in ice, through all the States. Like the edible crab, it is taken in pots, baskets, or nets.

The lobster breeds in the summer months, depositing many thousands of eggs in the sand, and leaving them there to be hatched by the sun. But few, as may easily be imagined, live to attain a size befitting them to appear in red livery on our tables. Like all crustaceans, the lobster casts its shell annually, and with such perfection, that the discarded garment, with all its feet and feelers, perfectly resembles the living animal. The process is curious enough to deserve a few lines of description. When, towards autumn, the time of casting the shell approaches, the lobster retires to a silent nook, like a pious hermit to his cell, and fasts several days. The shell thus detaches itself gradually from the emaciated body, and a new and tender cuticle forms underneath.

The old dress seems now, however, to plague the lobster very much, to judge by the efforts he makes to sever all remaining connection with it. Soon the harness splits right through the back, like the cleft bark of a tree, or a ripe seed-husk, and opens a wide gate to liberty. After much tugging and wriggling, the legs, tail, and claws gradually follow the body. The claws give the lobster most trouble; but he is well aware that perseverance generally wins the day, and never ceases till the elastic mass, which can be drawn out like india-rubber, and instantly resumes its ordinary shape, has been forced through the narrow passage. It can easily be supposed that, after such a violent struggle for freedom, the lobster is not a little exhausted. Feeling his weakness, and the very insufficient protection afforded him by his soft covering, he bashfully retires from all society until his hardened case allows him to mix again with his friends on terms of equality, for he well knows how inclined they are to bite and devour a softer brother.

In the seventh and last order of the class Crustacea is placed a curious group of animals forming the genus

LIMULUS.—King Crabs, or Crabs of the Moluccas. These animals have twenty-four legs; the ten anterior, with the exception of the two anterior in the males, are terminated by a two-fingered claw, and inserted, as well as the two following, beneath a large semilunar shield; the latter are in the form of large leaves, as well as the ten following, which are branchial, and annexed to the under side of a second, which is terminated by a horny,

movable style like a sword. One species, *L. Polyphemus*, is often found near our coasts; and we have frequently seen numerous specimens, after a storm, strewn lifeless along our shores. It is from one to two feet in length.

As the other orders of this class contain nothing of peculiar interest, we close our observations on the Crustaceans with a few general remarks.

The facility with which the Crustacea cast off their legs, and even their heavy claws, when they have been wounded in one of these organs, or alarmed at thunder, is most remarkable. Without the least appearance of pain, they then continue to run along upon their remaining legs. After a time a new limb grows out of the old stump, but never attains the size of the original limb.

The wonderful metamorphoses of the insects are universally known, but the changes which the young crabs have to undergo ere they assume their definitive form are no less astonishing. We are indebted to Mr. Vaughan Thompson for the first discovery of the metamorphoses of the Common Crab; and since then the evolutions of many other Crustaceans have been observed by other naturalists, so that most likely all the more perfect Crustaceans undergo analogous changes.

Before Mr. Thompson's observations, the small creatures, which he proved to be young crabs, were considered as belonging to a distinct genus, called Zoca. "On creeping out of the egg, these larvae look very strange indeed. Fancy a preposterously large helmet-shaped head, ending behind in a long point, and furnished in front with two monstrous sessile eyes, like the windows of a lantern. By means of a long, articulated tail, the restless chimaera continually turns, so to speak, 'head over heels.' Claws are wanting; while the old crabs have eight legs, the young have only four, armed at the extremity with four long bristles, that are continually pushing food towards the ciliated and ever active mouth. Who could imagine that a creature like this should ever change into a crab, with which it has not the least resemblance? But time does wonders. Immediately after the first casting of the skin, the body makes an approach to its future permanent form; the eyes are raised on stalks; the claws and feet begin to develop themselves; but as yet the metamorphosis is incomplete, for the tail remains long, like that of the lobster, and is used by the young crab to swim about merrily in the water. It is not before the next stage, when the little creature measures about one eighth of an inch in diameter, that the crab form is completely developed by the tail shortening, and finally disappearing under the shield.

"In these successive metamorphoses, we see the peculiarities of several stages of formation. In the first, the crab is like one of the lowest and

most incomplete Crustaceans; farther on it resembles the lobster, and at last it appears in the compact shape which constitutes the highest perfection of crustacean life."

CLASS III. OF ARTICULATA. ARACHNIDA.

This class embraces the Spiders and Scorpions. Like the preceding class, it is composed of species which are, in a manner, not liable to change their form, not undergoing metamorphosis, but simple sheddings of the outer covering of the body. But they differ from these animals, as well as from the true insects, in many respects. As in the latter, the surface of their bodies exhibits orifices or transverse slits, named stigmata (but which it would be better to name pneumostomes,—mouth for the air,—or spiracles, that is, respiratory orifices), serving for the entry of the air, but being few in number (eight at most, generally only two), and situated only on the under side of the abdomen. Respiration is effected either by means of aerial branchiaæ, serving as lungs and enclosed in bags, to which these spiracles form the entry, or by means of radiating tracheæ. The organs of sight consist only of minute simple ocelli, grouped in different positions when there is a number of them. The head, generally united to the thorax, merely exhibits at the place of the antennæ two articulated pieces, like small didactyle or monodactyle claws, which have been injudiciously compared to the mandibles of insects, and so named; but they move in a direction opposed to the motion of mandibles, or up and down, assisting, nevertheless, in eating, and replaced, in those Arachnida which have the mouth formed into a siphon, or sucker, by two pointed plates, used as lancets. A sort of lower lip (*labium*, Fab.), or rather tongue (*langouette*), formed by a pectoral elongation; two maxillaæ, formed of the basal joint of two small feet or palpi, or of an appendage or lobe of the same joint; a piece concealed beneath the mandibles, and called the sternal tongue by Savigny in *Phalangium capticum*, and which is composed of a beak-like prominence, produced by the union of a very small epistome or clypeus, terminated by a very small triangular upper lip, and of a longitudinal lower rib (*cariène*), generally very hairy. These, together with the pieces called the mandibles, generally constitute, with certain modifications, the mouth of the majority of the Arachnida.

"The majority of the Arachnida feed upon insects, which they seize alive, or upon which they fix themselves, and from which they suck their juices. Others live as parasites upon the bodies of vertebrated animals. There are, however, some which are found only in flour, cheese, and upon various vege-

tables. Those which subsist upon other animals often increase in a very great degree. In some species two of the legs are not developed before a change of skin, and in general it is not until after the fourth or fifth moulting that these animals become fitted for reproduction."

ORDER I. OF ARACHINIDA. PULMONARIA.

This order comprises those species which have pulmonary sacs, a heart with distinct vessels, a system of circulation, and six or eight eyes.

ARANEA.—The Spiders. There are no creatures more common than these curious beings, and few that are not looked upon with more favor and less disgust. Every morning the housewife has to clean with brush or broom numerous corners and by-places of the "filthy cobwebs," placed there the previous night by these indefatigable workers. There is no place secure from their intrusion, no part of a human dwelling where they do not at times pursue their wonderful labors. The spider has eyes like those of a cat, and sees in the night as well as in the day, and while we are sleeping, may be constructing its marvellous palace on the very ceiling of our parlor. The white, silky masses seen floating in the air in spring and autumn mornings are evidences of its nocturnal industry.

It is probable that many of the spiders, not having a sufficient supply of silk, merely emit single threads—such, for instance, as those made by young *Lycosæ*, which are to be seen in great abundance, crossing from ridge to ridge, in cultivated lands, when they reflect the sun's rays. When chemically analyzed, they are found to exhibit precisely the same characters as the silk of spiders, and are, therefore, not formed in the air, as has been conjectured by Lamarck. Gloves and stockings have been made of spiders' silk; but these attempts, not being capable of a general application, and being subject to great difficulties, are more curious than useful. The material is, however, far more important for the spiders themselves. It is by its means that the sedentary species, or those which do not chase after their prey, construct their webs of a more or less firm texture, capable, in some exotic species, of holding small birds, and of which the forms and positions vary according to the habits peculiar to each species, and which are so many snares in which the insects which serve them for food are captured. Scarcely is one caught by the hooks of the tarsi, than the spider, sometimes placed in the centre of its web, or in a cell near one of its angles, darts forth, approaches the insect, uses all its efforts to wound the captive with its murderous darts, and to discharge into the wound an active poison. When it opposes too strong a resistance, and a struggle may be dangerous to the

spider, the latter retires for a time, until it has lost its strength, and becomes still more entangled in its ineffectual efforts to escape, when, there being no longer cause for alarm, the spider returns, and endeavors to twirl it round, weaving at the same time around it a strong, silken web, in which it is sometimes entirely encased. Lister states that the spiders discharge their threads in the same manner as the porcupine is fabulously asserted to do, with this difference — that the threads of the spider remain attached to its body. This fact has been considered impossible. We have, however, seen the threads issue from the nipples of some *Thornisi*, extending in a straight line, and forming movable rays when the animal moves them circularly. Another use of silk common to all female spiders is for the construction of cocoons destined for the enclosure of the eggs. The contexture and the form of these cocoons are varied according to the habits of the various races of spiders. They are generally spheroid; some have the shape of a cap or a flat sphere; some are placed on a peduncle, and others are terminated by a club. Other matters, such as earth, leaves, &c., sometimes cover them, or at least partially; a finer tissue often envelops the eggs in the inside, where they are loose or agglutinated together, and are more or less numerous.

The spider's web is undoubtedly one of the most curious and extraordinary objects in nature. Most wonderful is the tenuity of these fairy-like lines, yet strong enough to enable the aerial voyager to run through the air, and catch his prey which ventures within its domain. It is so fine that, in the web of the Gossamer Spider, the smallest of the tribe, there are twenty tubes, through which are drawn the viscid globules, the gummy matter it employs in spinning. It takes one hundred and forty of these globules to form a single spiral line: it has twenty-four circumlocutions to go through, which gives the number of three thousand three hundred and sixty. We have thus got the average total number of lines between two radii of the circle; multiplying that number by twenty-six, the number of radii which the untiring insect spins, gives the total amount of eighty-seven thousand three hundred and sixty viscid globules before the net is complete.

The dimensions of the net, of course, vary with the species. Some will be composed of as many as one hundred and twenty thousand lines; yet even to form this net, the spider will only take five minutes! Wonderful, indeed, is the process by which the spider draws the thread from its body — more wonderful than any rope or silk-spinning. Each of these spinnerets is covered with rows of bristle-like points, so very fine that a space about the size of a pin's head will cover a thousand of them. From each of these points or tubes issues a small but slender thread, which unites with the other

threads, so that from each spinneret proceeds a series of threads forming one compound whole; these are situated about one third of an inch from the apex of the spinnerets; they also unite and form one thread, six hundred and twenty-four of which are used by the spider in forming his net. With the instrument which nature has given him,—the claws of his feet,—the spider guides and arranges the glutinous thread as this seemingly inexhaustible fibre is drawn from his body, and interweaves them with each other until the web is complete. In this way spiders are weavers of a supple line, whose touch, for quickness and fineness, surpasses that of any spinning-jenny.

A. *Domestica*.—These animals are found everywhere. They construct in our houses, in the angles of walls, upon plants and hedges, in the ground or under stones, large webs nearly horizontal, at the upper end of which is a tube in which they station themselves.

A. *Aquatica*.—The Water Spider. This animal is blackish-brown, with the abdomen darker colored, silky, and with four impressed dots on the back. It resides in standing water, in which it swims with the abdomen encased in a bubble of air, and in which it forms for its retreat an oval cell filled with air and formed of silk, from which threads proceed to the different adjacent water plants in all directions. Here it devours its prey, constructs its egg-case, which it carefully guards, and where it passes the winter, having first closed the cell.

Another species of weaving-spider (*Epeira diadema*, Linn.) is of a large size, with the abdomen marked with a triple cross formed of small white spots. It abounds most in autumn. The eggs, which the parent deposits at the commencement of the cold weather in angles of the ceilings of rooms, in passages, near gardens, and in walls, enveloping them with a loose, white silken web, are hatched in the spring of the following year.

Another singular species is described by Dufour under the name of *Uroctea maculata*. "It is about half an inch long, of a brown maroon color, with the abdomen black, marked with five yellowish spots. Found in the south of Europe and Egypt. Dufour has made some curious observations on its habits. It constructs on the under side of stones, or in crevices of rocks, a cocoon in the shape of a cap or patella an inch in diameter, its circumference having seven or eight festoons, the points alone being fixed to the stone by means of threads, whilst the edges of the festoons are free. This singular tent is of an admirable texture, the outer surface resembling the finest taffety, and composed of a number of folds. When young it only constructs two layers, between which it takes its station. But subsequently, perhaps at each moulting, it adds additional folds, and when the period of reproduction arrives, it weaves another apartment, expressly for the reception

of the sacs of eggs and young when hatched, of a softer texture. The inside of its habitation is always singularly clean. The bags in which the eggs are placed are four, five, or six in number in each habitation; they are about one third of an inch in diameter, and of a lenticular form. It is not until the end of December or January that the eggs are deposited, and they are enveloped in fine down to guard them from the cold. The edges of the festoons not being fastened together, the insect is able to creep in and out at will by lifting them up. When the young are able to dispense with the maternal cares, they quit their common habitation, and form separate abodes, and their parent dies in her tent, which is thus the birthplace and tomb of the Uroctea."

The effects of changes of temperature and weather on the proceedings of these creatures, and the appearance of their webs, very early attracted the attention of mankind, and gave rise to the art of *Araneology*—a method of deciding on the changes of the weather from the motions and works of spiders. Intimations of it appear even in Pliny (II. N., book xi., sect. 28). It is also treated of in the "*Ewigwährenden Practica*" (Things of Everlasting Value), which appeared at Gorlitz in 1588. In later times Quatremère Disjonval, member of the Academy of Sciences at Paris, during an eight months' imprisonment, in which some spiders were his only companions, made various observations on the subject; and in 1797, at Paris, made known his discovery of the close connection existing between the appearance or disappearance, the labor or rest, the greater or less circumference of the webs and fibres, of spiders of different sorts, and the atmospherical changes from fair weather to rain, from dry to wet, and particularly from hot to cold, and from frost to a milder temperature. In the genus

Lycosa is the celebrated *Tarentula*, so named from the city of Tarentum, in Italy, in the environs of which it is common. These spiders live on the ground, and run with great swiftness. They dwell in holes, lining the inside with silk, and increasing the size as they grow. Some inhabit the holes of walls, where they make silken tubes, the outside of which they cover with earth or sand, and in which they moult and hibernate. It is the opinion of the vulgar that the venom of the *Tarentula* occasions dangerous wounds, often fatal, or followed by a singular kind of delirium called *tarentism*, which can only be cured by music and dancing. All spiders are, in a degree, poisonous, we believe, but not to the extent ascribed to the *Tarentula*, and the medical art supplies effective remedies.

MYGALE.—In this genus are some of the largest species of the family. They have eight eyes, and form their nests in the slits of trees, beneath the bark, in the cavities of stones, or on the surface of leaves of various vegetables. They feed on crickets, cockroaches, and, according to M. Moreau

de Jonnes, the young of humming-birds. One species, the Mason, or Mining Spider, constructs, in dry, shelving situations exposed to the sun, subterranean, cylindrical galleries, often two feet deep, and so tortuous that traces of them are often lost. They also construct, at the entrance, a movable lid of silk and earth, fixed by a hinge, which, by its exact size, inclination, and weight, so closely shuts the opening that it can scarcely be distinguished from the neighboring soil. In these hidden retreats it secretes itself, and waits for its prey. A very large species of Mining Mygale is found in Texas.

SCORPIO.—The Scorpions. These animals are all peculiar to hot climates, and in all ages have been objects of dread. The agony caused by their sting has, from the earliest times, been employed by the poets as a figure of mental anguish, or of the torments of conscience. The great dramatist makes Macbeth thus describe the tortures of his soul: "O, full of scorpions is my breast, dear wife!"

The body of the Scorpion is elongated, and terminates abruptly in a jointed tail, armed at the extremity with a curved and very acute spine; under the point of this spine are two very small orifices, which serve to give passage to a poisonous fluid. The anterior pair of feet, or palpi, are very large, resembling those of the lobster in form, and serve to seize and bear to the mouth of the animal the various insects on which it feeds; the other feet do not differ essentially in form from those of the spider. At the junction of the thorax and abdomen are two movable plates, having the form of combs, the use of which is not well understood. Several species of scorpions are known—all inhabiting the warmer parts of the globe. They shun moisture, living on the ground in places exposed to a hot sun, and hiding under stones or in crevices, and, when disturbed, run rapidly, with their tails curved over their backs. The species of the south of Europe are little more than an inch in length, while some of the tropical species exceed five inches. The sting of the larger ones is very much dreaded, and is said frequently to cause death. In some places they are so numerous as to become a constant object of apprehension to the inhabitants, and even force them to abandon their habitations. The Scorpions may be divided into two sections, viz., those with eight eyes, and those which have only six, like the species which inhabit the Southern States. The poison increases in power according to the age of the animal, but may be neutralized by the application of volatile alkali, either internally or externally.

ORDER II. OF ARACHNIDA. TRACHEARIAE.

This order is divided into three families, the first of which is composed of the *Pseudo-Scorpiones*—False Scorpions. With the exception of one or two species discovered in Cuba, they inhabit the hot countries of the Old World. They are small animals, having from two to four eyes, can run with considerable swiftness, often sidewise, like the crab, dwell beneath stones, decaying bark, and sometimes in old books and herbariums.

In the second family are the *Pycnogonides*. These are marine animals, found among marine plants, under stones near the shore, and sometimes on whales.

In the third family are several genera, which contain a large number of well-known species. The most of them have eight legs, although some have but six.

PHALANGIUM.—This genus comprises those singular-looking animals called Harvest Men. They have eight very long legs, which, when detached from the body, exhibit, for some time, signs of life. Most of them live on the ground at the roots of trees, and are very active; others conceal themselves beneath stones, or in the moss.

TROMBIDIUM, Fabr., has the chelicerae terminated by a movable claw; palpi projecting, pointed at tip, with a movable appendage or finger beneath the extremity; two eyes, each at the top of a small, fixed peduncle. *T. holosericeum*, Fabr., very common in gardens during spring, of a blood-red color, with the abdomen nearly square, and narrowed behind. A much larger species (*T. cinctorium*, Fabr.) inhabits the East Indies, and emits a red dye.

ERYTHRÆUS, Latr., has the chelicerae and palpi of Trombidium, but the eyes are sessile, and the body not divided.

GAMASUS, Latr., has the chelicerae didactyle, and the palpi projecting, distinct, and filiform. In some the body is covered entirely, or in part, by a scaly skin, but in others it is entirely soft. Some of the latter species live upon different birds and quadrupeds; others, as the *Acarus telarius*, Linn., or the Red Spider of the hot-houses, form upon the leaves of various vegetables, especially upon those of lime trees, very fine webs, which injure them greatly. This species is reddish, with a black spot on each side of the abdomen.

ACARUS.—The Acarides are universally distributed. Some are wanderers; and, amongst these, some are found under stones, leaves, the bark of trees, in the ground, the water, or upon provisions—such as flour, dried meat, old dry cheese, and upon putrid animal matters. Others subsist as

parasites upon the skin and in the flesh of different animals, often greatly weakening them by their excessive multiplication. The origin of certain diseases is attributed to them. Other sorts of mites are also found upon insects; and many beetles, which subsist upon cadaverous substances, are often entirely covered with them. They have even been observed in the brain and eyes of man. The mites are oviparous, and exceedingly prolific. Many of them are born with only six feet, and the two others are developed a short time afterwards. It has been asserted that they produce the disease called *itch*, by insinuating themselves beneath the skin. This, however, is an erroneous opinion. They are found, it is true, in the pustules of the itch, as a *result* of the disease, and not its cause. They are created, and make their appearance, only after the pustules are formed.

1. *Domesticus*. — The most of these animals are very small, or almost microscopic. They occur everywhere, some being of a wandering character, and to be found under stones, leaves, the bark of trees, or in provisions, as meal, cheese, pepper, &c.; others are stationary and parasitic, on the skin of various animals, sometimes proving of serious injury to them. The mites inhabiting cheese are so minute, that, to the naked eye, they appear like moving particles of dust. They are very quick-sighted, and when once they have been touched with a pin, it is curious to observe the cunning which they display to avoid a second touch. They are extremely voracious, and will even prey on each other, and are so tenacious of life that they have been kept alive for many months between the object-glasses of a microscope. The species which is found in meal occasions considerable injury. Leuwenhock states that they may be expelled by placing a few nutmegs in the vessel or sack containing the meal. A German writer, named Funke, advises a cheaper remedy, which consists of the decorticated, thick branches of the lilac, or elder, which are to be put in the flour, and will, it is said, completely prevent their depredations.

IXODES. — This genus comprises the Ticks. They have no perceptible eyes; the palpi are in the shape of valves, dilated at the tip, serving as a sheath to the sucker, of which the parts are horny and toothed; the body is clothed with a corneous skin, or at least with a scaly plate in front. These ticks are parasites, sucking the blood of various vertebrated animals; and, although at first very much flattened, they acquire, by suction, a very large size, and become swollen out like a bladder. They are round or oval. They are found in thick woods, abounding in brushwood, briars, &c., attaching themselves to low plants by the two fore legs, extending the other feet. They fasten upon dogs, cows, horses, and other quadrupeds, and even upon the tortoise, burying their suckers so completely in their flesh that they can hardly be detached by force, and by tearing away the portion of skin

to which they are fastened. They deposit a prodigious number of eggs, discharging them from the mouth, according to M. Chabrier. Their multiplication upon the ox and horse is sometimes so great that these animals perish from exhaustion. The tarsi are terminated by two unguis inserted upon a plate, or are united at the base upon a common peduncle. The ancients appear to have known these animals under the name of Ricini. They are our well-known Ticks, one species of which attaches itself to sheep, and another to oxen. It is sometimes found embedded in the skin, and I have seen them over a half inch in length.

CLASS IV. OF ARTICULATA.—INSECTA.

There is no department of the animal kingdom which offers a more varied and interesting field for investigation than the Insect World; nor is there any class of animated creatures that exhibits, in a more wonderful manner, the wisdom, and condescension, and benevolence of the Almighty, than those tiny beings that creep and flutter through their little life, fulfilling, for the most part, in a few months, the mission and end for which Nature called them into existence. The gorgeous and beautiful colors of some, the extraordinary intelligence of others, and the remarkable structure and habits of all, always excite sentiments of admiration, and often feelings of amazement.

M. Louis Figuier furnishes the following brief but very correct description of the class: —

" If we wish to characterize insects by their exterior aspect, we might consider them as articulate animals, whose bodies, covered with tough and membranous integuments, are divided into three distinct parts: the head, provided with two antennæ, and eyes and mouth of very variable form; a trunk, or thorax, composed of three segments, which has underneath it always six articulated limbs, and often above it two or four wings; and an abdomen composed of nine segments, although some may not appear to exist at first sight.

" If, in addition to these characteristics, one considers that these animals are not provided with interior skeletons; that their nervous system is formed of a double cord, swelling at intervals, and placed along the under side of the body, with the exception of the first swellings, or ganglions, which are under the head; that they are not provided with a complete circulating system; that they breathe by particular organs, termed tracheæ, extending parallel to each other along each side of the body, and communicating with the exterior air by lateral openings termed spiracles; that their sexes are

distinct; that they are reproduced from eggs; and, in conclusion, that the different parts we have mentioned are not complete until the creature has passed through several successive changes, called metamorphoses,—a general idea may be formed of what is meant in zoölogy by the word 'insect.'

There are but few vegetable substances which do not fall under the attacks of insects; and as those which are useful or necessary to man are not less liable to them than the others, they often cause great damage, especially in seasons favorable for their multiplication. Their destruction depends greatly on our knowledge of their habits, and on our own vigilance. Some are omnivorous, such as the White Ants, Ants, &c., of which the ravages are too well known. Many among these are carnivorous; and the species which feed upon carcasses or excrement are a benefit conferred on us by the Author of Nature, and compensate, in some respect, for the losses and inconveniences which the others cause to us. Some species are employed in medicine and in the arts, as well as our domestic economy. They have also many enemies: fishes destroy a great quantity of aquatic species; many birds, bats, lizards, &c., rid us of many of those which live upon the ground or in the air. The majority strive to avoid the dangers which menace their existence, by flying or running away; but there are some which employ for this purpose particular stratagems or natural arms, and exhibit reasoning powers of a most extraordinary character, as will appear as we place under examination the several genera.

"Like vegetables, the species of insects are subject to geographical limits. Those, for example, of the New World (with the exception of a small number of the northern species) are essentially peculiar to it: it also possesses many genera equally peculiar. The Old World, on the other hand, possesses others unknown in America. The insects of the south of Europe, North Africa, and the west and south of Asia, have great general resemblance. It is the same with those of the Moluccas, and the more eastern islands, including those of the South Sea. Many species of the north are found in the mountainous regions of more southern climates. Those of Africa differ greatly from those of the opposite countries of America. The insects of Southern Asia, commencing from the Indus, or Sind, and going to the east as far as the confines of China, have features greatly resembling each other. The intertropical regions, covered with immense damp forests, are the richest in insects; and in this respect Brazil and Guiana are the most highly favored.

"Arrived at their last transformation, and enjoying all their faculties, they hasten to propagate their race; and when this is performed, their existence soon terminates. Thus, in our climate, each season of the year (winter

excepted) presents to us many species which is peculiar to it. It nevertheless appears that the females, and neuters of those which live in society, have a longer existence. Many individuals bred in the autumn conceal themselves during the rigors of winter, and reappear in the following spring."

M. Lacordaire, in his "*Introduction à l'Entomologie*," makes some interesting observations in regard to the eyes of insects.

They are of two kinds, called compound eyes, or eyes composed of many lenses, united by their margins, and forming hexagonal *facettes*; and simple eyes, or *ocelli*. The exterior of the eye is called the cornea, each facette being a cornea; but the facettes unite and form a common cornea; these facettes, however, vary in size even in the same eye.

The facettes are the most numerous in the insects of the Beetle tribe, a beetle's eye having twenty-five thousand and eight; and least in that of the Ant, whose eye has only fifty facettes. On the under side of each facette we find a body of gelatinous appearance, transparent, and usually conical, the base of which occupies the centre of the facette in such a manner as to leave around it a ring to receive the pigment. This body diminishes in thickness towards its other extremity, and terminates in a point, where it joins a nervous filament, proceeding from the optic nerve. These cones, agreeing in number with the facettes, play the part of the crystalline, or lens, in the eyes of animals. They are straight and parallel with each other. A pigment fills all the spaces between the cones, between the nervous filaments, and covers the under side of each cornea, except at the centre. This pigment varies much in color. There are almost always two layers, of which the exterior one is the more brilliant. In truth, these eyes often sparkle with fire, like precious stones.

Of the wings of insects I shall speak when describing the typical species of the Winged Insects, merely mentioning here one extraordinary character of them. The buzzing and humming sounds produced by winged insects are not, as might be supposed, vocal sounds. They result from sonorous undulations imparted to the air by the flapping of their wings. This may be rendered evident by observing that the noise always ceases when the insect alights on any object. The siren has been ingeniously applied for the purpose of ascertaining the rate at which the wings of such creatures flap. The instrument being brought into unison with the sound produced by the insect, indicates, as in the case of any other musical sound, the rate of vibration. In this way it has been ascertained that the wings of a gnat flap at the rate of fifteen thousand times per second. The pitch of the note produced by this insect in the act of flying is, therefore, more than two octaves above the highest note of a seven-octave piano-forte.

Some curious researches have been lately made on the strength of insects.

M. Felix Plateau, of Brussels, has published some observations on this point, which we think of sufficient interest to be reproduced here.

In order to measure the muscular strength of man, or of animals,—as the horse, for instance,—many different dynamometric apparatus have been invented, composed of springs, or systems of unequal levers. The Turks' heads which are seen at fairs, and on which the person who wishes to try his strength gives a strong blow with the fist, represent a dynamometer of this kind. The one which Buffon had constructed by Régnier's Dynamometer is much more precise. It consists of an oval spring, of which the two ends approach each other; when they are pulled in opposite directions, a needle, which works on a dial marked with figures, indicates the force exercised on the spring. It has been proved, with this instrument, that the muscular effort of a man, pulling with both hands, is about one hundred and twenty-four pounds, and that of a woman only seventy-four pounds. The ordinary effort of strength of a man in lifting a weight is two hundred and ninety-two pounds; and a horse, in pulling, shows a strength of six hundred and seventy-five pounds; a man, under the same circumstances, exhibiting a strength of ninety pounds.

Physiologists have not as yet given their attention to the strength of invertebrate animals. It is, relatively speaking, immense. Many people have observed how out of proportion the jump of a flea is to its size. A flea is not more than an eighth of an inch in length, and it jumps a yard; in proportion, a lion ought to jump two thirds of a mile. Pliny shows, in his "Natural History," that the weights carried by ants appear exceedingly great when they are compared with the size of these indefatigable laborers. The strength of these insects is still more striking when one considers the edifices they are able to construct, and the devastations they occasion. The Termes, or White Ant, constructs habitations many yards in height, which are so firmly and solidly built, that the buffaloes are able to mount them, and use them as observatories; they are made of particles of wood joined together by a gummy substance, and are able to resist even the force of a hurricane.

There is another circumstance which is worth being noted. Man is proud of his works; but what are they, after all, in comparison with the ant, taking the relative heights into consideration? The largest pyramid in Egypt is only one hundred and forty-six yards high, that is, about ninety times the average height of man, whereas the nests of the Termites are a thousand times the height of the insects which construct them. Their habitations are twelve times higher than the largest specimen of architecture raised by human hands. We are, therefore, far beneath these little insects—as far as strength and the spirit of working go.

The destructive powers of these creatures, so insignificant in appearance, are still more surprising. During the spring of a single year, they can effect the ruin of a house by destroying the beams and planks. The town of La Rochelle, to which the Termites were imported by an American ship, is menaced with being eventually suspended on catacombs, like the town of Valencia in New Grenada. It is well known what destruction is caused when a swarm of locusts alight in a cultivated field; and it is certain that even their larvæ do as much injury as the perfect insect. All this sufficiently proves the destructive capabilities of these little animals, which we are accustomed to despise.

M. Plateau has studied the power of traction in some insects—the power of pushing in the digging insects, and the lifting power of others during flight. He has thus been able to make some most interesting comparisons, of some of which we will relate the results. The average weight of man being one hundred and forty-two pounds, and his power of traction, according to Régnier, being one hundred and twenty-four pounds, the proportion of the weight he can draw to the weight of his body is only as eighty-seven to a hundred. With the horse the proportion is not more than sixty-seven to a hundred—a horse thirteen hundred and fifty pounds in weight only drawing about nine hundred pounds. The horse, therefore, can draw little more than half his own weight, and a man cannot draw the weight of his own body. This is a very poor result, if compared with the cock-chafer. This insect, in fact, possesses a power of traction equal to more than fourteen times its own weight. If you amuse yourself with the children's games of making a cock-chafer draw small cargoes of stones, you will be surprised at the great weight which this insignificant looking animal is able to accomplish.

To test the power of traction in insects, M. Plateau attached them to a weight by means of a thread fastened to one of their feet. The Coleoptera (Beetles) are the best adapted for these experiments.

The following are some of the results obtained by the Belgian physician: *Carabus auratus* can draw seven times the weight of its body; *Nebria brevicollis*, twenty-five times; *Necrophorus vespillo*, fifteen times; *Trichius fuscatus*, forty-one times; and *Orystes nasicornis*, four times only. The bee can draw twenty times the weight of its body; *Donacia nymphæ*, forty-two times its own weight.

From this it follows that if the horse possessed the same strength as this last insect, or if the insect were the size of the horse, they would either of them be able to draw one hundred and fifty-five thousand two hundred and fifty pounds! Experiments have been made on the lifting power of insects by fastening a ball of soft wax to a thread attached to the hind legs. The proportion of the weight lifted has been found equal to that of the body.

The class Insecta is divided into twelve orders, as follows:—

I. *Myriapoda*; II. *Thysanoura*; III. *Parasita*; IV. *Suctoria*; V. *Coleoptera*; VI. *Orthoptera*; VII. *Hemiptera*; VIII. *Neuroptera*; IX. *Hymenoptera*; X. *Lepidoptera*; XI. *Strepsiptera*; and XII. *Diptera*.

ORDER I. MYRIAPODA.

This order has twenty-four or more legs, arranged along the whole length of the body, upon a series of rings, each of which bears one or two pairs, and of which the first, and also the second in many species, appear to form part of the mouth. They are *apterous*—that is, without wings.

The Myriapodes resemble generally small serpents, or Nereides. They are commonly called *Centipedes*—hundred-footers. They are found everywhere in decayed wood, beneath stones and bark, and in moist places. In the Linnaean System, they form the single genus *Iulus*.

ORDER II. THYSANOURA.

The insects embraced in this order have six feet, and the abdomen furnished at the sides with movable pieces, in the form of false legs, or terminated by appendages fitted for leaping. They compose the two genera of Linnaeus—*Lepisma* and *Podura*. They inhabit houses, under damp boards, or beneath stones, and some dwell on trees, or beneath bark. Some of the species, as the *P. villosa*, live in society in the gravel or sand, resembling gunpowder; sometimes they are seen on the snow after a thaw.

ORDER III. PARASITA.

These creatures are destitute of wings; have six legs; have no organs of sight except ocelli; the mouth is interior, and only consists of a muzzle enclosing a retractile sucker, or of a slit situated between two lips, with two hooked mandibles. They compose but one genus—

PEDICULUS.—The Lice. “The body is flattened, nearly transparent, divided into eleven or twelve distinct segments, of which three, forming the trunk, have a pair of legs attached to each. The first of these segments often forms a kind of corselet. The spiracles are very distinct. The antennæ are short, of equal thickness throughout, composed of five joints, and often inserted in an excavation. Each side of the head exhibits one or

two minute ocelli. The legs are short, and terminated by a very strong nail, or by two opposing hooks, whereby these animals easily fasten themselves to the hairs of quadrupeds, or feathers of birds, of which they suck the blood, and upon the body of which they pass their lives, and there multiply, attaching their eggs to those cutaneous appendages. Their generations are numerous, and succeed each other very rapidly. Particular causes, unknown to us, are very favorable to their production; and this is especially the case in respect to the common Body Louse, in the disease named phthiriasis, and also in infancy. They always live upon the same quadrupeds and birds, or at least upon the animals of those classes which have analogous characters and habits. One bird, however, often supports two kinds of lice. They generally crawl very slowly."

Man supports three kinds, their eggs being known under the name of Nits. The Body Louse (*P. humanus corporis*, De Geer), white, without spots, which multiplies excessively in the disease called phthiriasis, and the Head Louse (*P. humanus capitis*, De Geer), ashy color, with darker spots, found only on the head of man, and especially of children, form Leach's genus *Pediculus*, having the thorax quite distinct from the abdomen. The *Pediculus pubis*, Linn., or Morpeon Crabs, or Crab-lice, forms Dr. Leach's genus *Phthirus*.

The lice are chiefly found among filthy persons, but sometimes, by accident, afflict respectable people. They are easily destroyed by applying oil to the head, or parts which they have attacked.

ORDER IV. SUCTORIA.

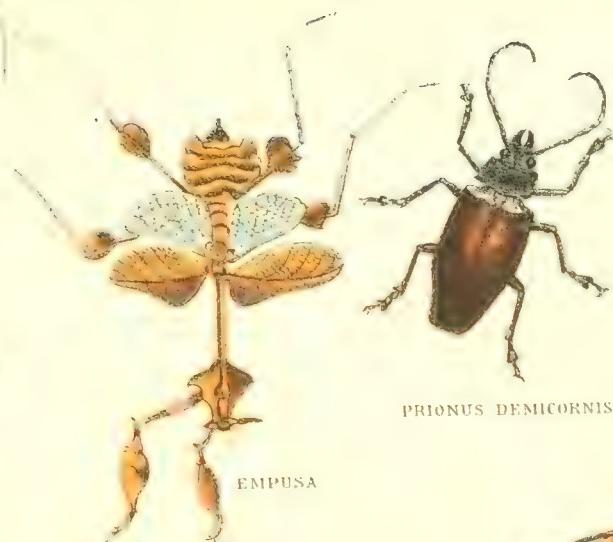
This order, like the preceding, has six legs, and is destitute of wings, and the mouth is composed of a sucker. The animals, however, undergo metamorphosis, which those of the former do not, and acquire thereby locomotive organs which they did not at first possess. The order comprises but one genus—

PULEX.—The Fleas. The body is oval, compressed, enclosed in a tough skin. The head is small, very compressed, rounded above, truncate, and ciliated in front. It has on each side a small, round eye, behind which is a cavity, in which is placed a small, movable body, furnished with minute spines. The legs are robust, particularly the posterior, fitted for leaping. The two fore legs are inserted almost beneath the head, and the beak is placed between them.

The female lays about a dozen white, slightly viscid eggs, whence emerge small larvæ, destitute of legs, very much elongated, resembling minute



PRIONUS DEMICORNIS



CALICHROMA

EMPUSA



ATTACUS LUNA



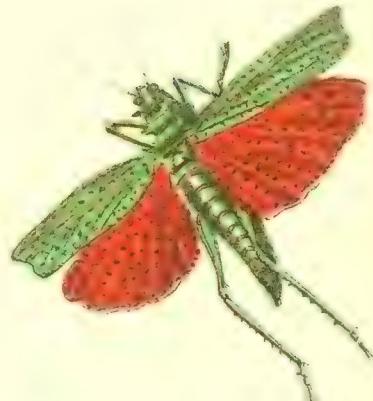
ATTACUS CECROPIA



AESCHNA JUNIA.



CENTRIS GROSSA



RUTIDODERUS SQUARROSA

worms, very active, coiling themselves up in a circle or spire, serpentine in their progress, at first white, and afterwards reddish. Their body is composed of a scaly head, without eyes, bearing two very minute antennæ and thirteen segments, with small tufts of hair and a pair of little hooks at the tip of the last. The mouth exhibits a few small, movable parts, of which the larvæ make use in pushing themselves forwards. After living about twelve days under this form, these larvæ enclose themselves in a small silken cocoon, where they become pupæ, and whence they make their escape in the perfect state at the expiration of a similar period.

P. Irritans. — The Common Flea feeds on the blood of man, the dog, and cat. Its larva lives amongst dirt, and beneath the nails of filthy persons; also in the nests of birds, such as pigeons, attaching itself to the necks of the young, and gorging itself till it becomes red.

P. Penetrans. — The Chigoe, or Jigger, forms a peculiar genus. Its beak is of the length of the body. It inhabits the tropical regions of America, where it is the terror of the natives. It introduces itself beneath the nails of the feet and the skin of the heel, where it soon acquires the size of a small pea, by the quick growth of the eggs, which it bears in a large membranous bag beneath the abdomen, the numerous family from which occasions, by remaining in the wound, an ulcer very difficult to heal, which even sometimes becomes mortal. Frequent washings, and rubbing the feet with fresh tobacco leaves, or those of other bitter plants, are preventives against its attacks. The negroes, or more commonly the negresses, are in the habit of extracting the insect, with great skill, from its lodgment.

These singular little creatures appear to possess no small degree of intelligence, and are capable, strange as it may seem, of some education. Geoffrey ("*Histoire abrégée des Insectes*") mentions that an Englishman succeeded in making a gold chain the length of a finger, with padlock and key to fasten it, not exceeding a single grain in weight. A flea attached to the chain pulled it easily. He relates another fact still more wonderful. An English workman constructed a carriage and six horses of ivory. The coachman was on the box, with a dog between his legs; there were also a postilion, four persons in the carriage, and two servants behind, and the whole drawn by one flea.

Baron Walchenaer, author of the "*Histoire Naturelle des Insectes Aptères*," is responsible for the following remarkable account. In 1825, an extraordinary exhibition amazed the people of Paris; it was no less than a company of trained fleas. The learned baron says, "I saw and examined them with entomological eyes, assisted by a glass." To enable an assemblage of persons to witness the performance of these diminutive creatures in a large room, the spectators were seated in front of a curtain, provided

with magnifying glasses, through which they looked, as they would at a diorama, at landscapes, or buildings.

At this exhibition *thirty fleas went through military exercises, and stood upon their hind legs, armed with pikes, formed of very small splinters of wood.*

"Two fleas were harnessed to and drew a golden carriage, with four wheels and a postilion. A third flea was seated on the coach-box, and held a splinter of wood for a whip. Two other fleas drew a cannon on its carriage. These and other wonders were performed on polished glass. The flea-horses were fastened by a gold chain attached to the thighs of the hind legs, and which was never taken off. They had lived thus two years and a half, not one having died, and appeared to enjoy their mode of life. They were fed by being placed on a man's arm, which they sucked."

ORDER V. COLEOPTERA.

This order derives its name from the character of its wings, *Coleoptera* being a compound Greek word,—*koleos*, sheath, and *pteron*, wing,—signifying *sheath-wings*. These insects have four wings, of which the upper pair is crustaceous, and constitute the elytra or sheath.

"The elytra and wings arise upon the lateral and superior margins of the hinder division of the thorax. The elytra are crustaceous, and in repose are applied one against the other in a straight line along the inner margin, or suture, and are always in a horizontal position. In almost every instance they hide the wings, which are large, and folded transversely. Many species are wingless; but the elytra are always present. The abdomen is sessile, or united to the thorax by its greatest width: it is composed on the outside of six or seven segments, membranous above, or of a consistence less firm than on the under side.

"These insects, generally known under the English name of Beetles, are the most numerous and the best known of the insect tribes. Their singular forms, the brilliant colors exhibited by many of their species, the size of their bodies, the more solid texture of their teguments, which renders their preservation much more easy, and the numerous advantages to be derived from the investigation of such a variety of forms of their external organs, have merited for them the particular attention of naturalists.

"The head is provided with two antennæ of variable form, and of which the number of joints is generally eleven; two faceted eyes; no ocelli; and a mouth composed of an upper lip, two mandibles, mostly of a scaly consistency, two lower jaws (*maxillæ*), each bearing one or two palpi, and a

lower lip formed of two pieces, namely, the mentum and the tonguelet (*languette*), and accompanied by two palpi, generally inserted upon this latter piece; those of the maxillæ, or the outer maxillary palpi (when they bear two), have never more than four joints, whilst those of the lower lip have, ordinarily, only three joints.

"The anterior segment of the trunk, or that which is in front of the wings, or elytra, and which is commonly named the corselet, and which bears the first pair of feet, greatly surpasses in extent the two other segments, which are compactly united together, as well as to the base of the abdomen: their under part, or the sternum or breast, serves as a point of attachment to the two other pairs of feet. The second of these segments, upon which is placed the scutellum, is narrower in front, so as to form a short peduncle, which is received into the inner cavity of the first segment, and which serves as a pivot to assist in all its movements.

"Beetles undergo a complete metamorphosis. The larva resembles a worm, with a scaly head and mouth, analogous in the number and functions of its parts to that of the perfect insect, and also with six legs: some species, however, few in number, are destitute of these appendages, or have only simple fleshy tubercles.

"The pupa is inactive, and does not take any nourishment. The habitation, mode of life, and other habits of these insects, both in their immature and perfect states, vary very much."

The immense multitude and variety of the genera and species, which compose this order, compel us to select certain typical groups, exhibiting the most prominent and remarkable characteristics and habits of the family to represent the whole. It is estimated that there are over one hundred thousand different species, besides many that have not yet received examination and a name from naturalists.

The first division of this order is well represented by the genera *Cicindela* and *Carabus*.

CICINDELA.—These insects have a robust head, with great eyes, and jaws very advanced and toothed. Some of the species are of a green color, of various shades, with shining metallic tints, and with white spots upon the elytra. They choose their dwelling in dry, sunny situations, run with considerable swiftness, and when alarmed, fly off, but alight at a short distance.

The larvae of some have very singular habits. They form a round hole in the earth, of considerable depth, in the construction of which they employ their feet and jaws. They detach the grains of earth, and place them on the concave back of their head; and when their load is as large as they can carry, they ascend backwards, resting at intervals against the inner walls

of their burrow. When they have arrived at the surface, they cast off their burden, with a jerk, to a considerable distance. While lying in ambush for prey, the flat plate of the head just fits the mouth of the hole, forming a flat surface with the surface of the surrounding soil. They seize their victim with their jaws, and even rush upon it, precipitating it to the bottom of their burrows, with a see-saw motion of their head. They descend then with equal quickness at the least danger. They close the orifice of their dwelling when they change their skin, or undergo their change to the pupa state.

CARABUS.—Many of the species of this group are destitute of wings, and have only elytra. They often emit a fetid odor, and discharge an acrid and caustic liquid. The Carabici are very active insects, and live in the earth, under stones, or the bark of trees. Some of them secrete a very caustic fluid, which they discharge with an explosion. If the fluid falls upon the skin, it produces a stain like that made by nitric acid, and sometimes a painful burn. Some species are social, and live in societies under stones. One species (*C. sycophanta*) is three fourths of an inch in length, of a velvet black, with the elytra golden-green, or brilliant copper, finely striated, each having three lines of fine, impressed dots. Its larva lives in the nests of the processionary caterpillars, upon which it feeds, devouring many in the course of a day. Other larvae of its own species, smaller and younger, attack and devour it when its voracity has overcome its activity. They are black, and are sometimes found running on the ground, or upon trees, especially the oak.

A second family of the Coleoptera is represented by the genera *Dytiscus* and *Gyrinus*, and is called HYDROCANTHARI—the Swimmers. Their feet are formed for swimming. They pass the first and last state of their existence in fresh water. They swim well, and rise to the surface of the water, from time to time, to respire, ascending easily by holding their feet still, and suffering themselves to float. The body being turned upside down, they slightly elevate the tip of the body above the surface of the water, raising the extremity of the elytra, or bending down the abdomen, so that the air introduces itself into the spiracles, which they cover, and thence into the tracheæ. They are very voracious, and feed upon small animals, which ordinarily reside in the water, which the Hydrocanthari only leave during the night. They emit a very disagreeable odor. Sometimes they are attracted by light into the interior of houses. Their larvae have a long, narrow body, composed of twelve segments, of which the first is the largest, with the head strong, and armed with two powerful mandibles.

DTISCUS.—The larvae of this genus suspend themselves at the surface of the water by means of two appendages at the sides of the tail, which

they keep dry by raising them above the surface. When they wish to change their place suddenly, they give their body a quick and vermicular movement, beating the water with the tail. They especially feed upon the larvæ of dragon-flies, gnats, tipulæ, aselli, &c. When the period of their transformation has arrived, they quit the water and bury themselves under the earth of the adjacent banks, keeping, however, in very damp situations, where they form an oval cavity in which they enclose themselves. According to Rœsel, the eggs of the *Dytiscus marginalis* hatch ten or twelve days after being deposited: at the end of four or five more, the larva is already four or five lines long, and moults for the first time. The second change of skin takes place at the expiration of a similar interval, and the animal is now as large again as it was before: when full grown it is two inches long. In summer it has been observed to become a pupa at the end of fifteen days, and a perfect insect in fifteen or twenty more days.

D. Marginalis. — This is a common species, an inch and a quarter long, being of a dark-olive color, with a buff-colored margin entirely round the thorax, and a line of the same color on the outer margin of the elytra, which are not dilated at the sides; those of the female are furrowed from the base about two thirds of the whole length. Fabricius says that the species when laid upon its back gains its ordinary position by taking a leap. Esper kept a specimen of this insect for three years and a half in good health in a large bottle of water, feeding it every week, and sometimes oftener, with bits of raw beef about the size of a walnut, upon which it precipitated itself and sucked the blood entirely from it. It was able to fast for a month at a time. It killed a specimen of *Hydrophilus piceus*, although as large again as itself, by piercing it between the head and thorax, the only part of the body without defence. According to Esper, it is sensible to the changes of the atmosphere, which it indicates by the heights at which it keeps in the bottle.

GYRINUS. — According to Cuvier, this genus comprises those insects which have the antennæ in a mass, and shorter than the head; the two fore legs are long, advanced like arms, and the four others very short and depressed, broader and oar-like. The eyes are four in number; the body is oval, and generally very shining; the antennæ, inserted in a cavity before the eyes, have the second joint exteriorly elongated, like an ear, and the following joints (of which seven are only distinctly visible) very short, and closely united into a mass nearly like a spindle, and rather bent; the head is inserted into the thorax as far as the eyes, which are large, and divided by a ridge on the sides, so that there appear two above and two below; the upper lip is rounded, and very much ciliated in front; the palpi are very small, and the inner pair of the maxillary are wanting in many species.

The thorax is short and transverse; the elytra are obtuse or truncated at the posterior extremity; the two fore legs are slender, long, folded up, and held nearly at right angles with the body when shut up, and terminated by a very short, compressed tarsus, of which the under side is clothed with fine plush in the males. The four other feet are broad, very thin, like membrane, and the joints of the tarsi form small leaves.

The insects, which are called Whirlwigs, or Whirligigs, from their peculiar motions, are, in general, of small or but moderate size. They are to be seen, from the first fine days of spring till the end of autumn, on the surface of quiet waters, and even upon that of the sea, often assembled in great numbers, and appearing like brilliant points. They swim or run about with extreme agility, curveting in a circular or oblique, or indeed in every direction, whence their ordinary French name of Tourniquets, or their English name given above. Sometimes they remain stationary, without the slightest motion; but no sooner are they approached than they escape by darting under the surface of the water, and swimming off with the greatest agility. The four hind legs are used as oars, and the fore ones for seizing the prey. Ordinarily stationed upon the surface of the water, the upper side of the body is always dry; and when they dart down, a bubble of air, like a silvery ball, remains attached to the hind part of the body. When seized, they discharge a milky fluid, which spreads over the body, and probably produces the disagreeable odor which they then emit, and which lasts a long time upon the fingers. Sometimes they remain at the bottom, holding upon plants, where also they possibly hide themselves through the winter.

In the third family are found the following interesting genera: *Buprestis*, *Lampyris*, *Ptinus*, and *Elater*.

The *Buprestidæ* are noted for their splendid colors, some of which have spots of gold on emerald ground, while others exhibit a variety of metallic colors.

LAMPYRIS.—The *Lampyridæ* have the elytra weak and soft, like the insects of the preceding tribe. In their perfect state, they frequent flowers. Their larvæ are carnivorous, attacking other insects or worms. It is to this group that the *Lampyris noctiluca*, or Glow-worm, which one sees shining during summer nights on grass and bushes, belongs. The luminous properties with which these insects are endowed have for their object to reveal their presence to the opposite sex; for the females alone possess these properties. In the same way as sounds or odors exhaling from some insects attract the one towards the other sex, so with the *Lampyris* a phosphorescent light shows the females to the males. The seat of the phosphorescent substance varies according to the species. It exists generally under the three last rings of the abdomen, and the light is produced by

the slow combustion of a peculiar secretion. It has been stated that it is evolved quickly when the animal contracts its muscles, either spontaneously or under the influence of artificial excitement. Some chemical experiments have been made to ascertain the nature or the composition of the humor which produces this strange effect; but, up to this moment, they have only enabled us to discover that the luminous action is more powerful in oxygen, and ceases in gases incapable of supporting combustion. In the most common species, the *Noctiluca*, or Glow-worm, the phosphorescence is of a greenish tint; it assumes at certain moments the brightness of white-hot coal.

The females have no wings, while the males have them, and possess very well-developed elytra. The females resemble the larvæ much, only they have the head more conspicuous, and the thorax buckler-shaped, like the male. The larvæ feed on small mollusks, hiding in the snail's shell after having devoured the inhabitant. They also possess the phosphorescent property in a less degree than the adult females. The female pupa resembles the larva; the pupa of the male, on the contrary, has the wings folded back under a thin skin. The perfect insect appears towards the autumn.

The Glow-worm (*L. noctiluca*) is of a brownish-yellow. It is a common insect. In a kindred species, the *Luciola Italica*, the two sexes are winged, of a tawny-brown, and equally phosphorescent. They are met with in great numbers in Italy, and the lawns are covered with them. Other insects of this family are without the faculty of emitting light; as, for example, the genus *Lycus*, of brilliant colors, which is met with in Africa and India. One of the finest is the *L. latissimus*.

Drilus is another genus, comprising insects of very singular habits. The type is the *D. flavescens*. The male,—a quarter of an inch long, black and hairy, with elytra of a testaceous yellow, and with pectinated antennæ,—for a long time, was alone known. The female—from ten to fifteen times as large, without wings and elytra, of a yellowish-brown—was not discovered till much later, having apparently nothing in common with the male in shape or color. The metamorphoses of these curious insects are now perfectly understood. Mielzinsky, a Polish naturalist established at Geneva, found the *Drilus* in the larva state in the shell of the *Helix nemoralis*. These larvae devour the snail whose dwelling they occupy, as do the larvæ of the *Lampyris*. Mielzinsky saw them emerge, but obtained only females, which differed scarcely at all from the larvæ from which they proceeded.

PTINUS.—The Ptiniores are all curious little insects. When touched, they counterfeit death by lowering the head, enclosing their antennæ, and contracting their feet, in which position they remain some time. Their larvæ are very injurious. Many of the species inhabit the interior of our

houses, where they do much injury, in the larva state, by gnawing furniture, books, &c., which they pierce with little round holes, like those made by a fine drill. Their excrement forms the fine white powder observed in the holes of worm-eaten wood. Other larvæ feed upon flowers, wafers, collections of birds, insects, &c. The two sexes, when calling each other during the period of their amours, beat with their jaws upon the wood-work on which they are stationed, for a succession of times, mutually replying to each other. This is the cause of the noise, similar to the quickened ticking of a watch, which is often heard, especially in old houses, and which has received from the superstitious the name of the Death-watch. *Anobium striatum*, Oliv. (*A. pertinax*, Fabr.), is of a uniform brownish-black color, and is very common in houses. *A. pertinax*, Linn., derives its specific name from the pertinacity with which it maintains its attempt at deception, preferring, according to De Geer, to suffer death under a slow fire, rather than give the least sign of life.

ELATER.—The Elateridae are rather large insects, often of hard texture, having the prosternum prolonged into a point, and the antennæ indented saw-wise. They have the power of jumping when placed on their backs, and of alighting again on their legs: hence their name of Elater (derived from the same root as the word *elastic*). They produce, in leaping, one sharp rap, and often knock many raps when they are prevented from projecting themselves. This is the mechanism which permits the Skip-jack to execute these movements. It bends itself upwards by resting on the ground by its head and the extremity of the abdomen, and then it unbends itself suddenly, like a spring; the point at the end of the thorax penetrates into the hollow of the next ring; the back then strikes with force against the plane on which it rests, and the animal is projected into the air. It repeats this manœuvre till it finds itself on its belly; for its legs are too short to allow of its turning over. Its structure supplies it with the means and the strength of rebounding as many times as it falls on its back, and it can thus raise itself more than twelve times the length of its body.

In America are found phosphorescent *Elateridæ*. These are the Pyrophori, which the Spaniards of South America call by the name of Cucuyos. They have at the base of their thorax two small, smooth, and brilliant spots, which sparkle during the night; the rings of the abdomen also emit a light. They give light sufficient to enable one to read at a little distance. The *Pyrophorus noctilucris* is very common in Havana, in Brazil, in Guiana, in Mexico, &c., and may be seen at night in great numbers in the foliage of trees. At the time of the Spanish conquest, a battalion, just disembarked, did not dare to engage with the natives, because it took the Cucuyos, which were shining on the neighboring trees, for the matches of the

arquebuses ready to fire. "In these countries," says M. Michelet, "one travels much by night to escape from the heat. But one would not dare to plunge into the peopled shades of the deep forest if these insects did not reassure the traveller. He sees them shining afar off, dancing, twisting about; he sees them near at hand, on the bushes by his side; he takes them with him; he fixes them on his boots, so that they may show him his road and put to flight the serpents; but when the sun rises, gratefully and carefully he places them on a shrub, and restores them to their amorous occupations. It is a beautiful Indian proverb that says, 'Carry away the fire-fly, but restore it from whence thou tookest it.'"

The Creole women make use of the Cucuyos to increase the splendor of their toilets. Strange jewels! which must be fed, which must be bathed twice a day, and must be incessantly taken care of, to prevent them from dying. The Indians catch these insects by balancing hot coals in the air at the end of a stick to attract them, which proves that the light which these insects diffuse is to attract. Once in the hands of the women, the Cucuyos are shut up in little cages of very fine wire, and fed on fragments of sugar-cane. When the Mexican ladies wish to adorn themselves with these living diamonds, they place them in little bags of light tulle, which they arrange with taste on their skirts. There is another way of mounting the Cucuyos. They pass a pin, without hurting them, under the thorax, and stick this pin in their hair. The refinement of elegance consists in combining with the Cucuyos humming-birds and real diamonds, which produce a dazzling head-dress. Sometimes, imprisoning these animated flames in gauze, the graceful Mexican women twist them into ardent necklaces, or else roll them round their waists, like a fiery girdle. They go to a ball under a diadem of living topazes, of animated emeralds, and this diadem blazes or pales according as the insect is fresh or fatigued. When they return home, after the *soirée*, they make them take a bath, which refreshes them, and put them back again into the cage, which sheds, during the whole night, a soft light in the chamber. In 1766, a Cucuyo, brought alive from America to Paris, probably in some old piece of wood which happened to be on the vessel, caused great terror to the inhabitants of the Faubourg St. Antoine when they saw it flying in the evening, glittering in the air. In 1864, a number of Cucuyos were brought from Mexico to Paris by M. Laurent, captain of the frigate *La Floride*. An experiment, made in the laboratory of the Ecole Normal, showed that the spectrum of their light is continuous, without any black rays; it differs, besides, from the spectrum of the solar light by a greater intensity of the yellow color. The light is produced probably, as it is in the case of the *Lampyris*, by the slow combustion of a substance secreted by the animal. The Cucuyo can, nevertheless, at will, increase or diminish

the splendor of this light by means of membranes, which it superposes, like screens, in front of the phosphorescent bumps which it has on its thorax.

In the Indies, and in China, the women use for dressing their hair, or as ear-rings, another Coleopteron of the same tribe, which begins even to be employed for this purpose by the women of the south of France. It is a Buprestis, of splendid colors, and of metallic brightness.

In the fourth division of this order, we find the singular genus

NECROPHORUS.—These insects derive their generic name from the peculiar habit they have of burying small animals. They are sometimes called Sextons, Burying Beetles, and Undertakers. When they have discovered a dead mouse or mole, they creep beneath it, and dig away the earth until a grave, sufficiently large to receive the body, has been excavated, when they place the carcass therein, after having deposited their eggs within it; their larvæ feed on the decaying body. All the species have a strong smell of musk. Their power of scent is extraordinary; they smell the dead nearly as soon as killed, from an immense distance, and hasten to perform their funeral rites.

As the fifth family presents no prominent characteristics, we pass on to the sixth division, which contains the great and interesting groups *Scarabeus*, *Melolontha*, and *Cetonia*.

SCARABEUS.—This genus is composed of species peculiar to the Old World. They have a rounded body, depressed above, with antennæ, nine-jointed, and with a leaf-like club. They enclose their eggs in balls of excrement, like large pills,—whence they are called Pill-makers,—which they roll along with their hind feet until they reach the hole where they are to be deposited. In this labor they often work in company.

S. Sacer.—This species and one other were known to and worshipped by the ancient Egyptians, who introduced them into their hieroglyphical writings. Their effigies are represented on all the monuments, and models of them, executed in the most precious materials, were worn as amulets around the neck.

MELOLONTA.—The most commonly known insect of this genus is the Cock-chafer. The French word for Cock-chafer, *Hanneton*, according to M. Mulsant, comes from the Latin *Alitonus* (sonorous wings), which first became Halleton. Linnæus gave these insects first the name of *Melolontha*, which they probably had among the Greeks, and which seems to be the case from this passage in Aristophanes, in his comedy of "The Clouds :" "Let your spirit soar; let it fly whither it lists, like the Melolontha tied with a thread by the leg." We see that the habit of martyizing Cock-chafers is of

very early date. The Common Cock-chafer is one of the greatest pests to agriculture. In its perfect state it devours the leaves of many trees, principally those of the elm ; and so children, in some countries, call the fruit of the elm tree by the name of "Bread of the Cock-chafer." But the destruction which they occasion in their perfect state is little when compared with that which is caused by their larvae—those white grubs so dreaded by agriculturists.

Cock-chafers make their appearance in the month of April if the season is warm. But it is in the month of May that they show themselves in great quantities. And so they are called in Germany Maikäfer (May-chafer, or May-bug). They are met with also in June. The duration of their life as a perfect insect is six weeks. They fear the heat of the day, and the bright sunshine ; so, during the day, they remain hooked on to the under surface of leaves. It is only early in the morning, and at sunset, that one sees the Cock-chafers fluttering around the trees which they frequent. They fly with rapidity, producing a monotonous sound by the friction of their wings. But the Cock-chafer steers badly when it flies. It knocks itself at each instant against obstacles it meets with. It then falls heavily to the ground, and becomes the plaything of children, who are constantly on the lookout for them. There is a saying, "*stupid as a May-bug.*"

What contributes still more to render the flight of these insects heavy and sustained only for a short time together, is, that they are obliged to inflate themselves, like balloons, in order to rise into the air. It is a peculiarity which they share with the migratory locusts. Before taking its flight, the Cock-chafer agitates its wings for some minutes, and inflates its abdomen with air. The French children, who perceive this manœuvre, say then that the Cock-chafer "*compte ses écus*" (is counting his money), and they sing to it this refrain, which has been handed down for many generations :—

" Hanneton, vole, vole !
Va-t'en à l'école !"

" May-bug, fly, fly !
To the school hie !"

During the day the Cock-chafers remain under the leaves in a state of perfect immobility ; for the heat, which gives activity to other insects, seems, on the contrary, to stupefy them ; and it is during the night only that they devour the leaves of elms, poplars, oaks, beeches, and birches. In years when their number is not very great, one hardly perceives the damage done by them ; but at certain periods they appear in innumerable legions, and then whole parts of gardens or woods are stripped of their verdure, and present, in the middle of summer, the appearance of a winter landscape. The trees thus stripped do not in general die ; but they recover their former

vigor with difficulty, and, in the case of orchard trees, remain one or two years without bearing fruit. It is principally the trees skirting woods, and situated along cultivated fields, which are exposed to the ravages of the Cock-chafer, because the larvæ of these insects are developed in the fields. In the interior of forests they are never met with in great numbers.

In certain years Cock-chafers multiply in such a frightful manner that they devastate the whole vegetation of a country. M. Louis Figuier, in his "Insect World," says that, in the environs of Blois, fourteen thousand Cock-chafers were picked up by children in a few days. At Fontainebleau they could have gathered as many in a certain year in as many hours. Sometimes they congregate in swarms, like locusts, and migrate from one locality to another, when they lay waste everything. To present an idea of the prodigious extent to which Cock-chafers increase under certain circumstances, we will give a few statistics. In 1574, these insects were so abundant in England that they stopped many mills on the Severn. In 1688, in the county of Galway, in Ireland, they formed such a black cloud that the sky was darkened for the distance of a league, and the country people had great difficulty in making their hay in the places where they alighted. They destroyed the whole of the vegetation in such a way that the landscape assumed the desolate appearance of winter. Their voracious jaws made a noise which may be compared to that produced by the sawing of a large piece of wood; and in the evening, the buzzing of their wings resembled the distant rolling of drums. The unfortunate Irish were reduced to the necessity of cooking their invaders, and, for the want of any other food, of eating them. In 1804, immense swarms of Cock-chafers, precipitated by a violent wind into the Lake of Zurich, formed on the shore a thick bank of bodies heaped, one on the other, the putrid exhalations from which poisoned the atmosphere. On May 18, 1832, at nine o'clock in the evening, a legion of Cock-chafers assailed a diligence on the road from Gournay to Gisors, just as it was leaving the village of Talmontiers; the horses, blinded and terrified, refused to advance, and the driver was obliged to return as far as the village to wait till this new sort of hail-storm was over. M. Mulsant, in his "Monographie des Lamellicornes de la France," relates that, in May, 1841, clouds of Cock-chafers traversed the Saône, from the south-east in the direction of the north-west, and settled in the vineyards of the Mâconnais; the streets of the town of Mâcon were so full of them that they were shovelled up with spades. At certain hours, one could not pass over the bridge unless he whirled a stick rapidly round and round to protect himself against their touch.

This is a remarkable statement, but the French imagination is very creative.

CETONIA.—One of the most pleasing specimens of this group is the *C. aurata*, or Rose Beetle. It is nearly an inch in length, of a shining-green color above, coppery-red beneath, with white marks on the elytra. It frequents flowers, and has a special fondness for the rose, whence its name. In Russia the Rose Beetle is considered a very efficacious remedy for hydrophobia. In the governorship of Saratow, which is traversed by the Volga, hydrophobia is very frequent on account of the heats which reign during the whole summer in its arid steppes. The inhabitants, incessantly exposed to be bitten by mad dogs, have tried in succession a great many preparations to remedy the results of these terrible accidents. It appears that the Cetonia, dried and reduced to powder, has produced on many occasions good effects. This is the recipe which an inhabitant of Saratow published in a Russian journal, adding that he had employed it for thirty years, that not one of the patients treated by him had died, and that his remedy could be employed with success in all the phases of the disease. In spring they search at the bottom of the nests of the wood-ant for certain white larvæ, which they carefully preserve in a pot, together with the earth in which they were found, till the moment of their metamorphosis, which takes place in the month of May. The insect, which is the common Rose Beetle, is killed, dried, and kept in pots hermetically sealed, so that it may preserve the strong odor which it exhales in spring, which seems to be a necessary condition of the remedy proving efficient. When a case of hydrophobia presents itself, they reduce to powder some of these, and spread this powder on a piece of bread and butter, and make the patient eat it. Every part of the insect must enter into the composition of this powder, which, for this reason, cannot be very fine. During the whole time a patient is under treatment, he must avoid drinking as much as possible, or, if his thirst is very great, he must only drink a little pure water; but he may eat. Generally, this remedy produces sleep, which may last for thirty-six hours, and which must not be disturbed. When the patient wakes, he is, they say, cured. The bite must be treated locally, with the usual surgical appliances.

As to the dose of the remedy, that depends on the age of the patient and the development of the disease. They give to an adult, immediately after the bite, from two to three beetles; to a child, from one to two; to a person in whom the disease has already declared itself, from four to five. Given to a person in good health, the remedy, however, would be the least dangerous. In cases in which the symptoms of hydrophobia show themselves some days after the employment of the remedy, they recommence the treatment. They have also tried to prepare this remedy with insects collected, not in their larva, but in the imago state, by catching them on flowers; and it seems that these attempts have succeeded. According to

M. Bogdanoff, in many governorships of the south of Russia, the lovers of sporting are in the habit of making their dogs, from time to time, swallow (as a preservative) half of a *Cetonia*, with bread or a little wine.

Every one in those countries is persuaded of the efficacy of this means for stopping the development of the disease. One ought not, perhaps, to reject a belief so wide-spread and deeply rooted without some experiments to guarantee us in doing so; for medicine does not yet possess any remedy against hydrophobia. It might not, then, be useless to try this.

Two smaller species than the Rose Beetle, the *C. stictica*, and the *C. hirtella*, which has yellowish hairs, live on the flowers of thistles. Western Africa, the Cape, and Madagascar are very rich in species of *Cetoniæ*. Among the *Cetoniadæ* is the genus *Goliathus*—gigantic insects, which inhabit Africa. Their total length sometimes attains from three to five inches. Their colors are generally a dull white or yellow, which has nothing metallic about it, with spots of a velvety-black; these are due to a sort of a down, of an extreme thinness, and which very easily comes off. The head of these enormous Coleoptera is generally cut or scooped out, and is adorned sometimes with one or two horns. Their legs, strong and robust, are armed with spurs, and sometimes present on their exterior sharp indentations, which give to these insects a crabbed physiognomy, which their inoffensive habits are far from justifying. All these horns, and all these teeth, which look so terrible, are nothing, in fact, with a great number of these insects, but simple ornaments. They compose the picturesque uniform of the males. It is equivalent to the bear-skin caps, the flaming helmets, and the bullion-fringed epaulets of our soldiers. The dress of the female *Goliathus* is much more modest, as is becoming to the sex.

GESTRUPES.—As the name indicates, these insects make holes in the ground, which they scoop out in fields, generally under the excrement of beeves, which has grown dry. They fly at night with a dull, drowsy, buzzing sound. The

G. Stercorarius, the *Shard-borne Beetle*, has been immortalized by the great dramatic poet, who makes Macbeth exclaim,—

“Ere, to black Hecate’s summons,
The Shard-borne Beetle, with his drowsy hums,
Hath rung night’s yawning peal, there shall be done
A deed of dreadful note!”

In the section of Coleoptera named *Heteromera* are found the *Cantharidæ*, or Blistering Beetles. There are several genera, possessing, in various degrees, the same habits and vesicating qualities. They counterfeit death when seized, and many of them at such times emit a yellowish liquid

from the joints of the feet, which is caustic and of a penetrating odor. The most important group of the *Cantharidæ* is the genus

CANTHARIS.—The Cantharides of commerce (*Cantharis vesicatoria*) are of a beautiful green, attain to a size of four fifths of an inch, and are found on ash trees, lilacs, and other shrubs. Commerce, for a long time, brought them from Spain, and some still come from that country: hence the common name of Spanish Fly. As they live in great numbers together, collecting them is easier and less expensive than would be that of other species of the same family which are not gregarious, but which have the same medicinal properties. The presence of the Cantharides is manifested by the strong odor which they diffuse to some distance. When, by aid of this smell, they are discovered, generally settled on an ash, they are collected in the following manner: Very early in the morning, a cloth of light tissue is stretched out at the foot of the tree, and the branches are shaken, which causes the insects to fall. These, numbed by the cold of the night, do not try to escape. When there is a sufficient quantity, the four corners are drawn up, and the whole plunged into a tub of vinegar diluted with water. This immersion causes the death of the insects. They then carry them to a loft, or under a very airy shed. To dry them they spread them out on hurdles covered with linen or paper; and, from time to time, to facilitate the operation, they are moved about, either with a stick, or with the hand, which is more convenient; but it is then necessary to take the precaution of putting on gloves; for, if touched with the naked hand, they would cause more or less serious blisters. The same precaution must be observed in gathering them.

When the Cantharides are quite dry, they put them into wooden boxes, or vessels of glass or earthen ware, hermetically sealed, and preserve them in a place protected from damp. With these precautions they may be kept, for a long while, without losing any of their caustic properties. Dumeril made blisters of Cantharides which had been twenty-four years in store, and which had lost none of their energy. When dry, they are so light that a kilogramme contains nearly thirteen thousand insects. Arctius, a physician who flourished in Rome in the first century of our era, seems to have been the first to employ Cantharides, reduced to powder, as a means of vesication. Hippocrates administered them internally in cases of dropsy, apoplexy, and jaundice. But it is pretty nearly established that the Cantharides of the ancients were not the same species used at the present day. They were probably a kindred species—the *Mylablis chicorii*. A blistering principle has been extracted from these insects, called "Cantharidine." This organic product presents itself under the form of little shining flakes, without color, soluble in ether or oil. One atom of this matter applied to

the skin, and particularly to the lower lip, makes the epidermis rise instantaneously, and produces a small blister filled with watery liquid. In spite of the corrosive principle which the *Cantharis* contains, it is attacked, like other dried insects, by the *Dermestes* and the *Anthrenus*, which feast on them without suffering the smallest inconvenience.

C. Vittata is a species peculiar to our own country, and quite equal to the foreign insect in vesicating power. It inhabits the stocks and leaves of the potato.

In the last tribe of Coleoptera is placed the genus

COCCINELLA.—These very diminutive insects appear to inhabit all parts of the world. They live upon trees and plants, and beneath the bark of decaying trees, and under stones. They are easily known by the hemispherical form of their bodies, the number and arrangement of the spots on the elytra, which resemble a kind of inlaid work of black upon yellow or orange, and also by the quickness of their motions. These little insects are not only inoffensive, but extremely useful to man, as they destroy large numbers of plant lice and other small animals injurious to vegetation. They are the delight of children everywhere, by whom they are called Lady-birds. In the United States and England, the children greet the appearance of one with the couplet, —

“Lady-bird! Lady-bird! fly away home!
Your house is on fire! your children cry, ‘Come!’”

In France they call it the “*Bête à bon Dieu*,” i. e., “the creature of the good God.”

ORDER VI. ORTHOPTERA.—COCKROACHES. LOCUSTS.

The name of the Order *Orthoptera* signifies “straight wings,” and refers to the manner in which the wings are folded on the back of the insect. All orthopterous insects undergo a semi-complete transformation, the metamorphosis consisting merely of the increase and development of the wing-covers and wings, which are seen in a rudimentary form in the pupa. In all other respects the pupa and larva resemble the matured insect, eating and walking in the same manner. They are wholly terrestrial, and mostly vegetable eaters, although some are omnivorous.

They are divided into two families — *Cursoria* (*Runners*), and *Saltatoria* (*Leapers*). The first section comprises three genera.

FORFICULA.—The lower wings of this insect are very broad, and fold at the same time like a fan, and doubled up. The abdomen terminates in a

kind of pair of pincers, resembling those which the jewellers used formerly for piercing the ears, preparatory to inserting ear-rings, whence the French name of this creature, *Perce Oreille*, or Ear Piercer, and the English name Earwig. These insects live chiefly on the petals and stamens of flowers. They shun the light, and dwell in the cracks of trees, or under bark and stones. The female guards her eggs with much care, and watches over her larvæ, for a considerable time, with maternal solicitude.

BLATTA.—These Orthoptera have a flat, broad body, the thorax very much developed, the antennæ very long, and the legs thin but strong, which enable them to run with remarkable quickness. They diffuse around them a sickening odor, which often hangs about objects they have touched. Aristophanes, the comic Greek poet, mentions this peculiarity in his comedy of "The Peace." They come out mostly at night, and hide themselves during the day. They are the most cosmopolitan of all insects. Carried over in ships, they perpetuate everywhere, like weeds! Persian powder, composed of pulverized *pyrethra*, is an excellent means to employ for their destruction. A paste made of sugar of lead, flour, and molasses will also destroy them.

The generic name *Blatta* is derived from the Greek word *Blaptein*, which signifies to damage, and well indicates the destructive character of these insects. These disagreeable animals devour our eatables, abounding in kitchens, in bakers' shops, on board merchant vessels, &c. Their flattened bodies allow them easily to introduce themselves into the cracks of cases or barrels; so that, to be safe against their attacks, it is necessary, on long voyages, to shut up the goods in zinc-lined boxes, or cases made of sheet iron well soldered together.

Chamisso relates that the sailors having opened some barrels, which should have contained rice and wheat, found them filled with German Cockroaches—*Blatta Germanica*. This transubstantiation was not very agreeable to the crew! Other naturalists have seen this insect invading by millions bottles which had contained oil. The Cockroach is very fond also of the blacking on boots, and devours leather and all. One pupa eats the skin cast off by another pupa; but a Cockroach has never been known to attack another with a view to eating him afterwards.

The *Kakerlac Americana* is from one inch to one inch and a quarter long. It infests ships, running about at night over the sleeping passengers, and devouring the food. They are to be met with in all parts of the world. They abound particularly in the warm parts of America.

The *Blatta Orientalis* is more commonly met with than the above. It swarms in kitchens, and bakers' shops, provision shops, &c., where it hides

in the cracks of the walls, or against the hinges of the doors. It is a small, hideous animal, of a repulsive smell, and of a reddish-brown color. It is a little larger than the *Blatta Americana*.

In France it is called by various names, such as *Cafard*, *Panetièr*e, *Noirot*, and *Bête noir*. If, in the middle of the night, you suddenly enter, with a light, into the down-stairs kitchen, you will often see these little beasts running about on the table, and devouring the remains of the food with astonishing rapidity.

The largest specimens of the genus of which we are now treating is the *Kukerlac insignis*, which inhabits Cayenne and Brazil, and in length sometimes exceeds an inch and three quarters, and in the extent of its wings four inches and a half.

It is principally in hot countries that the Cockroaches do the greatest damage. In the Antilles, of which they are the pest, it is affirmed that they can, in one single night, bore holes through trunks, through cases, and through bags, and destroy objects which were supposed to be in perfect safety. Sometimes the walls, the floors, the beds, the tables, everything, in short, is infested by them; and it is impossible to find a way of preserving the food from their repulsive touch.

MANTIS.—These insects are inhabitants of temperate or hot climates, and reside chiefly on plants, the leaves of which they resemble in color. They are pretty insects, of very different habits from the preceding. They alone of the Orthoptera are carnivorous. They eat live insects, seizing their prey as it passes by them. They rest generally on shrubs, remaining for hours together perfectly motionless, the better to deceive other insects which are to become their victims. "It is this fixed, and, as it were, meditative attitude which has gained for them the name of *Mantis*, a Greek word, signifying 'diviner,' as it was imagined that in this attitude they interrogated the future. The manner in which they hold their long front legs, raised like arms to heaven, has also contributed to make this superstitious notion believed, and sufficiently explains the names given to diverse species of Mantidae,—such as *Nun*, *Saint*, *Preacher*, *Suppliant*, *Mendicant*, &c. Caillaud, the traveller, tells us that, in Central Africa, a Mantis is an object of worship."

According to Sparmann, another species is worshipped by the Hottentots. If by chance a Mantis should settle on a person, this person is considered by them to have received a particular favor from Heaven, and from that moment takes rank among the saints!

In France the country people believe that these insects point out the way to travellers. Mouffet, a naturalist of the seventeenth century, says on this subject, in a description of the Mantis,—

"This little creature is considered of so divine a nature, that to a child who asks it its way, it points it out by stretching out one of its legs, and rarely or never makes a mistake."

In the eyes of the Languedoc peasants the *Mantis religiosa* is almost sacred. They call it *Prega Diou* (*Prie Dieu*), and believe firmly that it performs its devotions—its attitude, when it is on the watch for its prey, resembling that of prayer. Settled on the ground, it raises its head and thorax, clasps together the joints of its front legs, and remains thus motionless for hours together. But only let an imprudent fly come within reach of our devotee, and you will see it stealthily approach it, like a cat who is watching a mouse, and with so much precaution that you can scarcely see that it is moving. Then, all of a sudden, as quick as lightning, it seizes its victim between its legs, provided with sharp spines, which cross each other, conveys it to its mouth, and devours it. Our make-believe Nun, Preacher, our *Prega Diou*, is nothing better than a patient watcher and pitiless destroyer.

Allied to the above is the subgenus *Phasma*—the Spectres. They have a very curious, filiform body, resembling a stick. Some species are a foot in length, and, notwithstanding their remarkable and monstrous shapes, are very harmless creatures. They love to repose in the sun, with their long stick-like legs stretched out in front. From their extraordinary appearance they are called "Devil's Horses," "Phantoms," and "Walking-sticks."

The second family of Orthoptera comprises the *Saltatoria*, or Leapers—the Crickets, Grasshoppers, and Locusts.

All these insects resemble each other in the disproportion which exists between their hind legs and the other pairs. Another characteristic which is common to them consists in the song of the males. This song, so well known, which seems to have for its object to call the females, is nothing but a sort of stridulation, or screeching, produced by the rubbing together of the wing cases, or elytra. But the mechanism by which this is produced varies a little in all the three kinds. With the Crickets, the whole surface of the wing cases is covered with thick nervures, very prominent and very hard, which cause the noise the insect produces in rubbing the elytra one against the other. With the Locusts, there exists only at the base of the elytra a transparent membrane, called the *mirror*, which is furnished with prominent nervures, and produces the screeching noise. And, lastly, in the Crickets, the thighs and elytra are provided with very hard ridges. The thighs, being passed rapidly and with force over the nervures of the elytra, produce the sound in the same way as a fiddle-bow when drawn across a violin. With all these insects the male alone is endowed with the faculty of producing sound.

The Crickets and Grasshoppers have very long, thin antennæ, whilst the Locusts have short antennæ, and either flattened or filiform, or swelling out at one extremity, like a club. The female of the first two is provided with an ovipositor in the shape of an auger.

In the Linnæan system these insects composed the single genus

GRYLLOPS.—Although later systemists have separated them into several genera, yet, as the nomenclature of the Swedish naturalist, for the most part, still prevails, I shall consider them according to his arrangement.

G. Campestris.—The Field Cricket. This insect loves dry and hot situations, where it constructs its dwelling, in which it lies in wait for its prey. It leaves this retreat only at night. It is very timid, and at the least noise ceases its song. If it is stationed on the side of its hole, it retreats into it the moment any one approaches.

The holes of these crickets are well known to country children, who take these insects by presenting a straw to them. The pugnacious cricket seizes it directly with its mandibles, and lets itself be drawn out of its hole. It is this which has given rise to the saying, “*A greater fool than a cricket.*” It is very susceptible of cold, and always makes the opening of its hole towards the south. It lives on insects and herbs.

G. Domesticus.—The House Cricket. This species is about half an inch long, of an ashy color, and is to be met with principally in bakers’ shops and country kitchens, where it hides itself, during the day, in the crevices of the walls, or at the back of the fireplaces. It eats flour, and also, perhaps, the little insects which live in flour.

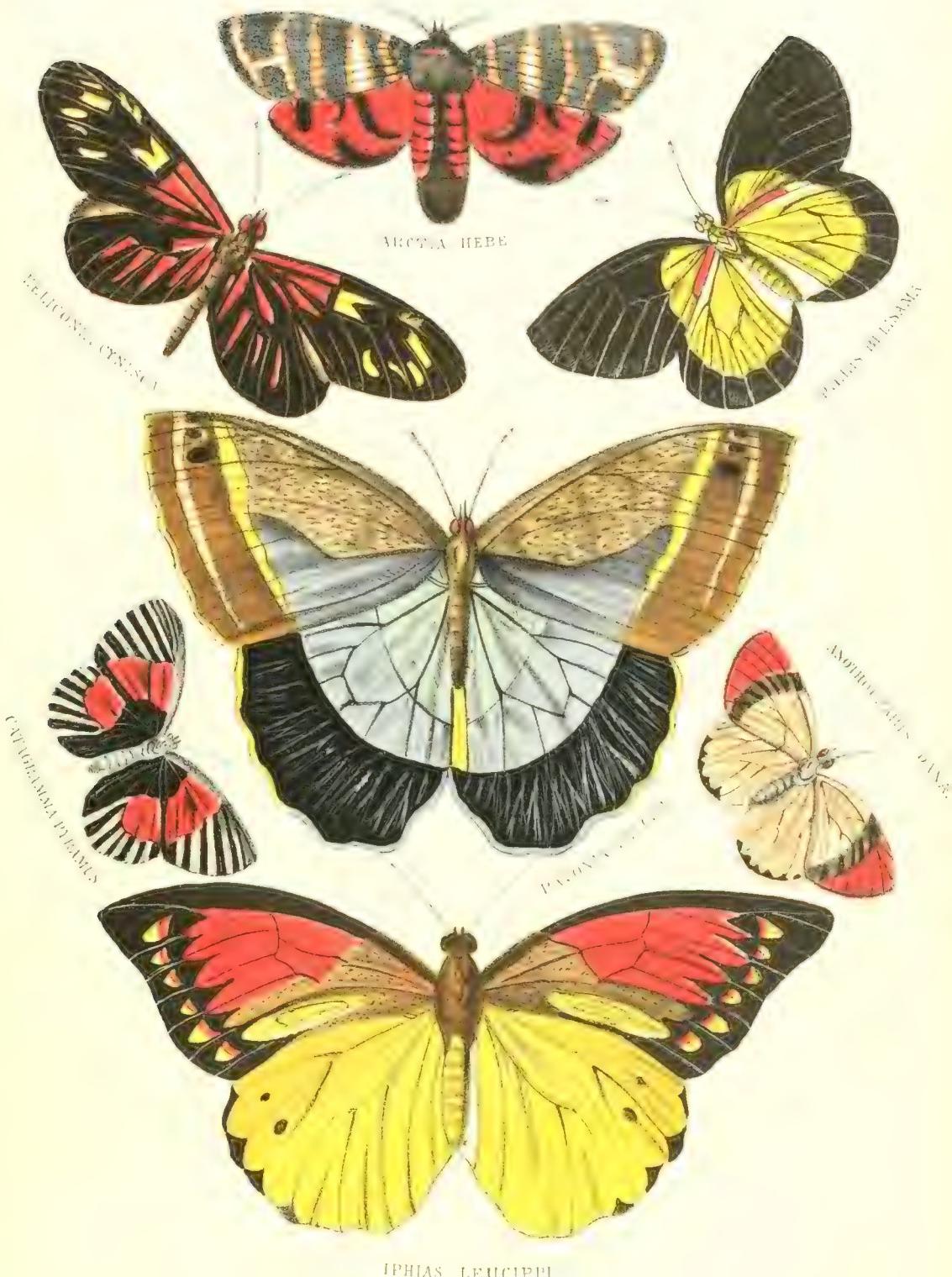
“The habits of the House Cricket are nocturnal, like those of its congener of the fields. It is only at night that it leaves its retreat to seek its food. When it is exposed against its will to the light of day, it appears to be in a state of torpor. This insect reminds one of the owl, among birds, not only from its habit of avoiding the light, but also from its monotonous song, which the vulgar consider—one does not know why—a foreboding of ill-luck to the house in which it is heard. Formerly this singular prejudice was much deeper rooted than it is at present. The song of the cricket has merely the object of calling the female.”

G. Sylvester.—Cricket of the Woods. This insect is much smaller than the above, and is met with in great numbers in the woods, where its leaps sometimes produce the noise of drops of rain.

G. Vulgaris.—The Mole Cricket. This species is an inch and a half long, and of a brown color. These crickets are distinguished from all other insects by the structure of their fore legs, which are wide and indented in such a manner as to resemble a hand, analogous to that of the mole. This hand betrays its habits much better than our hands betray ours. One need

ENTOMOLOGY.

Plate I



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not be much of a fortune-teller to read on it its digging habits. They make use of their hands, indeed, as spades, with which they hollow out subterranean galleries, and accumulate at the side of the entrance-hole the rubbish thus drawn. Their French name comes from the old French word *courtille*, which means garden. It reminds one that these are the favorite haunts of these destructive insects.

If the Mole Crickets have spades to their front legs, their hind legs are very little developed, so that it would be perfectly impossible for them to jump, particularly as their large abdomen would hinder their so doing. The wings are broad, and fold back in the form of a fan; they make little use of them, and it is only at nightfall that the Mole Cricket is seen to disport himself, describing curves of no great height in the air. It is found principally in cultivated land, kitchen gardens, nursery gardens, wheat fields, &c., where it scoops out for itself an oval cavity communicating with the surface by a vertical hole. On this hole abut numerous horizontal galleries, more or less inclined, which permit the insect to gain its retreat by a great many roads when pursued.

It is easy to understand that an insect which undermines land in this way must cause great damage to cultivation. Whether the crops serve it for food or not, they are not the less destroyed by its underground burrowings. Lands infested by the Mole Cricket are recognizable by the color of the vegetation, which is yellow and withered; and the rubbish which these miners heap up at the side of the openings leading to their galleries, resembling mole-hills in miniature, betrays their presence to the farmer. To destroy them, they pour water or other liquids into their nests, or else they bury, at different distances, vessels filled with water, in which they drown themselves. From the month of April the males betake themselves to the entrance of their burrows, and make their cry of appeal. Their notes are slow, vibrating, and monotonous, and repeated, for a long time, without interruption, and somewhat resembling the cry of the owl or the goat-sucker.

G. Viridissima.—The Great Green Grasshopper. This insect is two inches in length, entirely green, and without spots.

G. Locusta.—The Locusts. The *Locustide* are an exceedingly numerous family, and have been arranged by naturalists in numerous genera. Several varieties are peculiar to this country; one of the most remarkable is the "Seventeen-Year Locust," so called from the circumstance that they appear once in seventeen years. They sometimes fill the air, like clouds, and devour every green thing in their way. They emerge from the ground near the first of May, in the night, and in the pupa state. They begin to lay eggs about the first of June, on the twigs of trees; and as soon as the

young attain their growth in the grub state, they fall to the ground, and make their way two or three feet under the surface, to undergo their change into the pupa form. As soon as they undergo their last metamorphosis, they make their appearance, and commence their destructive career.

Many of the grasshopper tribe, especially of the musical kinds, are erroneously designated, by the common people, by the name of *Locust*. These musical insects are usually of a green color and nocturnal habits. They conceal themselves, during the day, in the grass, or foliage of trees; but at night they quit their hiding-places, and the exhilarated male makes the air resound with the song of love, by which he seeks to charm his silent partner. One of the best known of the insects is the "KATYDID" (*Locusta concava*, Say). Its large, oblong-oval, concave wing-cases enwrap the abdomen, and meet at their edges, above and below, very like the two sides of a peapod. Perched on the topmost twig of a tree, the insect begins its nocturnal call by separating, closing, and reopening his wing-cases. The friction of the tabouret frames upon each other thrice produces three distinct notes, which is the usual number, although sometimes only two are given. The mechanism of these organs reverberates and increases the sound to such a degree, that it may be heard, in the stillness of the night, a quarter of a mile. At intervals of three or four minutes, the joyous insect repeats his sonorous chant, while rival songsters echo the notes, and the woods resound with the cry of "Katy did! Katy didn't!" through the entire night.

The most destructive variety is the *Migratory Locust*, which is very common in Africa, India, and throughout the whole of the East. This insect is greenish, with transparent elytra of dirty gray, whitish wings, and pink legs. A second variety (the Italian Locust) also does a great deal of damage in the South. All these locusts undergo five moults, which take six weeks each; the last takes place at the end of the hot weather, towards the autumn.

It is especially in warm climates that they become such fearful pests to agriculture. Wherever they alight, they change the most fertile country into an arid desert. They are seen coming in innumerable bands, which from afar have the appearance of stormy clouds, even hiding the sun.

As far and as wide as the eye can reach, the sky is black, and the soil is inundated with them. The noise of these millions of wings may be compared to the sound of a cataract. When this fearful army alights upon the trees, the branches break, and in the course of a few hours, and over an extent of many leagues, all vegetation has disappeared; the wheat is gnawed to its very roots; the trees are stripped of their leaves; everything has been destroyed, gnawed down, and devoured. When nothing more is left, the terrible host rises, as if in obedience to some given signal, and takes its de-

parture, leaving behind it despair and famine. It goes to look for fresh food—seeking whom, or rather, in this case, what, it may devour! During the year succeeding that in which a country has been devastated by showers of locusts, damage from these insects is the less to be feared; for it happens often that, after having ravaged everything, they die of hunger before the laying season begins.

But their death becomes the cause of a greater evil. Their innumerable carcasses, lying in heaps and heated by the sun, are not long in entering into a state of putrefaction; epidemic diseases, caused by the poisonous gases emanating from them, soon break out and decimate the population. These locusts are bred in the deserts of Arabia and Tartary, and the east winds carry them into Africa and Europe. Ships in the eastern parts of the Mediterranean are sometimes covered with them at a great distance from the land. "Pliny relates that, in many places in Greece, a law obliged the inhabitants to wage war against the locusts three times a year; that is to say, in their three states of egg, larva, and adult. In the Isle of Lemnos the citizens had to pay as taxes so many measures of locusts. In the year 170 before our era, they devastated the environs of Capua. In the year of our Lord 181, they committed great ravages in the north of Italy and in Gaul.

"In 1690 locusts arrived in Poland and Lithuania by three different ways, and, as it were, in three different bodies. 'They were to be found in certain places where they had died,' writes the Abbé Ussares, an eye-witness, lying on one another in heaps of four feet in height. Those which were alive perched upon the trees, bending their branches to the ground, so great was their number. The people thought that they had Hebrew letters on their wings. A rabbi professed to be able to read on them words which signified God's wrath. The rains killed these insects; they infected the air; and the cattle, which ate them in the grass, died immediately.'

"In 1709 locusts stopped the army of Charles XII., King of Sweden, as it was retreating from Bessarabia, on its defeat at Pultowa. The king thought that he was assailed by a hail-storm when a host of these insects beat violently against his army, as it was passing through a defile, so that men and horses were blinded by this living hail, falling from a cloud which hid the sun. The arrival of the locusts had been announced by a whistling sound like that which precedes a tempest; and the noise of their flight quite overpowered the noise made by the Black Sea. All the country round about was soon laid waste on their route. During the same year a great part of Europe was invaded by these pests, the newspapers of the day being full of accounts relating to this public calamity. In 1755 Portugal was attacked by them. This was the year of the earthquake of Lisbon, and all sorts of plagues seemed at this time to rage furiously in that unfortunate country."

ORDER VII. HEMIPTERA.

The Hemiptera are furnished with a mouth fitted only for sucking. The delicate threads, of which the sucker is formed, enable them to pierce the vessels of plants and animals; and the nutritive fluid extracted is drawn up the main canal into the œsophagus. Most of these insects have coriaceous or crustaceous wing-covers, with the posterior extremity membranous, or semi-membranous. They undergo no transformation except in the development of wings and an increase of the size of the body.

The name of the order, *Hemiptera*, signifies *half wings*, and refers to the peculiar structure of those organs. The family is divided into two sections—the *Heteroptera* (different wings), and the *Homoptera* (similar wings). The insects of the first section have the wings and wing-covers always horizontal, or slightly inclined, and compose the two divisions *Geocorisæ* (Land Bugs), and *Hydrocorisæ* (Water Bugs).

The first division, Land Bugs, compose the three genera—*Cimex*, *Reduvius*, and *Hydrometra*.

CIMEX.—Some of the species have the sheath of the sucker composed of four distinct and exposed joints, and the upper lip prolonged beyond the head, like an awl. They suck other insects, and emit a very disagreeable odor.

C. Ornatus, known as the Red-Cabbage Bug, is very commonly found on the cabbage and most of the cruciferous plants. It is variegated with red and black, and its colors are subject to numerous variations.

C. Griseus (*Raphigaster griseus*) is common throughout all the temperate regions of the world. In autumn, these bugs are frequently to be found on raspberries, to which they impart their disagreeable smell. They are also to be found in quantities on the mullein when that plant is in flower. The upper parts of the head are of a grayish-brown, sometimes slightly purple. The coriaceous part of the hemelytra is of a purple tint, but the membranous part is brown. All these parts are covered with black spots, which are only to be seen with a magnifying glass. The wings are blackish. The under part of the whole body and the feet are of a light and rather yellowish-gray, with a considerable number of small, black spots. The abdomen is black above, and it is bordered with alternate black and white spots.

C. Lectularius.—The Bed-bug. This extremely offensive insect abounds in dirty houses, principally in towns, and, above all, those in warm countries. It lives in beds, in wood-work, and paper-hangings. There is no crack, however narrow it may be, into which it is unable to slip. It is

nocturnal, shunning the light. "Nocturnum fatidum animal," says Linnaeus. Its body is oval, about the fifth of an inch in length, flat, soft, of a brown color, and covered with little hairs. Its head is provided with two hairy antennæ, and two round black eyes, and has a short beak, curved directly under its thorax, and lying in a shallow groove when the animal is at rest. This beak, composed of three joints, contains four thin, straight, and sharp hairs. The thorax is dilated at the sides. The abdomen is very much developed, orbicular, composed of eight segments, very much depressed, and easily crushed by the fingers. The hemelytra are rudimentary. It has no membranous wings. The tarsi have three articulations, of which the last is provided with two strong hooks.

"These animals," says Moquin Tandon, in his "*Zoologie Medicale*," "do not draw up the sanguineous fluid by suction, properly so called, as leeches do. The organization of their buccal apparatus does not allow of this. The hairs of the beak, applied the one against the other, exercise a sort of alternate motion, which draws the blood up into the œsophagus, very much in the same manner as water rises in a chain pump. This rising is assisted by the viscous nature of the fluid, and, above all, by the globules it contains." The part of the skin which the bug has pierced, producing a painful sensation, is easily recognized by a little reddish mark, presenting in its centre a dark spot. Generally a little blister rises on the point pierced; and sometimes, if the bug bites are numerous, these blisters become confluent, and resemble a sort of eruption. These disgusting insects lay, towards the month of May, oblong, whitish eggs, having a small aperture, through which the larva comes out. The larva differs from the insect in its perfect state, in its color, which is pale or yellowish, and in having no hemelytra or wings. This insect exists in nearly all countries, although it is rare or almost unknown in the coldest regions. In the United States it is a universal pest. The towns of Central Europe are the most infested by this parasite, but those of the north are not completely free from its presence. The Marquis de Custine assures us that, at St. Petersburg, he found them numerous. It is found also in Scotland; is very rare in the south of Europe, and seldom seen in Italy, where it is, however, replaced by other insects, more dangerous or more annoying.

It has been said that this bug was introduced into Europe from America; but Aristotle, Pliny, and Dioscorides mention its existence. It is certain, however, that it was unknown in England till the beginning of the sixteenth century. The celebrated Spanish naturalist, Azara, has remarked that the bug does not infest man in his savage state, but only when congregated together in a state of civilization, and in houses, as in Europe and America. From this he concluded that the bug was not created till long after man,

when, after many centuries had elapsed since his appearance on the globe, men formed themselves into societies, into republics, or little states.

The bug is not a glutinous insect, always bloodthirsty; on the contrary, its sobriety is remarkable. It is only after a prolonged fast that it bites animals; and Andouin has stated that it can live a year, and even two years, without food.

REDUVIUS. — This genus has the proboscis short, very acute, and capable of pinching strongly. Some of the species produce a noise similar to that made by the Capricorn Beetle.

R. Personatus. — This insect inhabits the interior of houses, where it lives upon flies and other insects.

"This bug," says Charles de Geer, "has, in the pupal condition, or before its wings are developed, an appearance altogether hideous and revolting. One would take it, at the first glance, for one of the ugliest spiders. That which above all renders it so disagreeable to the sight is, that it is entirely covered, and, as it were, enveloped with a grayish matter, which is nothing else but the dust which one sees in the corners of badly-swept rooms, and which is generally mixed with sand and particles of wood, or silk, or other similar matters which come from furniture and clothes, rendering the legs of this insect thick and deformed, and giving to its whole body a very singular appearance."

"What instincts! what habits! Under this borrowed costume, under this cloak, which is no part of itself, the insect, as it were masked, has become twice its real size. What becomes of its disguise? and how does it manage to walk? Of what use to it is this dirty and grotesque fancy dress?

"It walks as fast, when it likes, as other bugs; but generally its walk is slow, and it moves with measured steps. After having taken one step forward, it stops for a while, and then takes another, leaving, at each movement, the opposite leg in repose: it goes on thus continually, step after step in succession, which gives it the appearance of walking as if by jerks, and in measure. It makes almost the same sort of movement with its antennæ, which it moves also at intervals and by jerks. All these movements have a more singular appearance than it is possible for us to describe."

By means of this disguise, it can approach little animals, which become its prey, such as fleas, spiders, and bed-bugs.

To see what a curious appearance the Reduvius presents, one should take off its borrowed costume. Then it will be seen to be an entirely different animal, and one which has nothing repulsive about it. With the exception of the hemelytra and wings, which it has not yet got, all its parts have the form which they are to have later, after the wings are developed.

HYDROMETRA (from *hudōr*, water, and *metrein*, to measure).—These insects have linear bodies; the head, which forms nearly a third of the entire length, is furnished with two long antennæ, and armed with a thin, hair-like beak. The legs are long, and of equal length.

II. Stagnorum.—The body and legs of this species are of a ferruginous color, the hemelytra a dull brown, and the wings hyaline, or glassy, and slightly blackish. Geoffrey says that it resembles a long needle, and calls it the Needle Bug. The reader may have often seen the *Stagnorum* walking by jerks on the surface of the water in a manner not unlike the movements of skaters.

The second family of the *Heteroptera* is composed of the Water Bugs. These insects have the antennæ inserted beneath the eyes, by which they are concealed, being shorter than the head. They are all aquatic and carnivorous, seizing other insects with their fore legs. Their proboscis is sharp, and is a powerful weapon; their eyes are of remarkable size. They compose the two genera—*Nepa* (Water Scorpions), and *Notonecta* (Boatmen).

The second section of the Hemiptera (HOMOPTERA) differs considerably from the foregoing. The proboscis arises from between the two fore feet. The wing-covers are roof-like, semi-membranous, and throughout of the same consistence. All the insects of this section feed entirely on the fluid of vegetables. They are divided into three families—*Cicadariae*, *Aphidii*, and *Gallinsecta*.

CICADA.—The animals comprised in this group have transparent wing-covers, and veined. The species are numerous, especially in the warmer regions of the globe, where the males fill the air with their noisy music. Some are adorned with brilliant hues, while others are destitute of color. Their song is monotonous and disagreeable, and yet the ancient Greeks revered the insect as the most mellifluous of singers, and poets and philosophers united in celebrating its musical qualities. It was with them a symbol of nobility, and Cicadas of gold ornamented the hair of those who laid claim to high birth.

The musical apparatus of the Cicada is somewhat remarkable, and we are indebted to a French naturalist (Réaumur) for the discovery of its exact mechanism. He shows us that it is not in the throat that the Cicada's organ of sound is placed, but on the abdomen. "On examining the abdomen of the male of a large species of Cicada one remarks on it two horny plates, of pretty good size, which are not found on the females; each plate has one side straight; the rest of its outline is rounded. It is by the side which is rectilinear that the plate is fixed immediately underneath the third pair of legs. It can be slightly raised with an effort by two spine-like

processes, each of which presses upon one of the plates, and, when it is raised, prevents it from being elevated too much, and causes it to fall back again immediately.

"If the two plates are removed and turned over on the thorax, and the parts which they hide laid bare, one is struck by the appearance which is presented — one cannot doubt that all one sees has been made to enable the Cicada to sing. When one compares the parts which have been arranged so that it may be able to sing, as we may say, from its belly, with the organs of our throats, one finds that ours have not been made with more care than those by means of which the Cicada gives forth sounds which are not always agreeable.

"We here perceive a cavity in the anterior portion of the abdomen, and which is divided into two principal cells by a horny triangle. The bottom of each cell offers to children, who catch the Cicada, a spectacle which amuses them, and which may be admired by men who know how to make the best use of their reason. The children think they see a little mirror of the thinnest and most transparent glass, or that a little blade of the most beautiful tale is set in the bottom of each of these little cells. That which one might see, if this were the case, would in no way differ from what one actually sees; the membrane, which is stretched out at the bottom of the cells, does not yield in transparency either to glass or to tale; and if one looks at it obliquely, one sees in it all the beautiful colors of the rainbow. It seems as if the Cicada has two glazed windows through which we can see into the interior of its body."

The Cicadas remain on trees, whose sap they suck by means of their sharp-pointed beaks. It is difficult enough to catch them, for, owing to their large, highly-developed wings, they fly rapidly away on the slightest noise.

They inhabit the south of Europe; the whole of Africa, from north to south; America, in the same latitudes as Europe; the whole of the centre and south of Asia, New Holland, and the islands of Oceanica. The Cicada, which in hot climates always exposes itself to the ardor of the most scorching sun, is not found in temperate or cold regions. The consequence is, that the southern nations know it very well, whilst in the north the large, green grasshopper, which is so common in those regions, and whose song closely resembles that of the Cicada, is commonly taken for it.

Another remarkable group of the *Cicadariæ* is the genus

FULGORÆ. — There are several species, some of which, especially in South America, are very large. They have very large, elongated heads, which nearly equals three quarters of the rest of the body. This prolongation is horizontal, vesiculous, enlarged to about the same breadth as the head, and

presents above a very great gibbosity. The antennæ are short, with a globular second articulation, and a small terminal hair.

F. Lanternaria. — The Lantern Fly is yellow, variegated with black. The elytra are of a greenish-yellow, sprinkled with black; the wings, of the same color, have at the extremity a large spot, resembling an eye, which is surrounded by a brown circle very broad in front. It inhabits Guiana. This remarkable insect enjoys a great renown on account of its luminous properties. Madame De Merian thus speaks of this peculiar character: —

"Some Indians having one day brought me a great number of the Lantern Flies, I shut them up in a large box, not knowing, then, that they gave light in the night. Hearing a noise, I sprang out of bed, and had a candle brought. I very soon discovered that the noise proceeded from the box, which I hurriedly opened; but, alarmed at seeing emerging from it a flame, or, to speak more correctly, as many flames as there were insects, I at first let it fall. Having recovered from my astonishment, or rather from my fright, I caught all my insects again, and admired this singular property of theirs."

The second family of the Homopterous Hemiptera, the *Aphidii*, contains some singular groups, one of the most extraordinary of which is the genus

APIIS. — The Plant Lice. These insects are small, and have the wing-covers and wings oval or triangular, the antennæ longer than the thorax, and the posterior portion of the abdomen furnished with two horns. They live chiefly in society, upon trees and plants, which they suck with their proboscis. They are not organized for leaping, and crawl but slowly. They multiply with astonishing fecundity, and often are very injurious to vegetation, covering the leaves of the rose, oak, apple, and other trees and plants by millions. The two horns at the extremity of the body, in several of the species, are tubes, from which they have the power of ejecting, at will, small drops of a transparent, honey-like fluid, of which the ants are very fond, and which they appear voluntarily to yield to them, whence they are sometimes called the "Ants' Cows." M. Huber describes the manner in which these insects are *milked*, so to speak, by the ants: —

"It had been already noticed," says this celebrated observer, "that the ants waited for the moment at which the Plant Lice caused to come out of their abdomen this precious manna, which they immediately seized. But I discovered that this was the least of their talents, and that they also knew how to manage to be served with this liquid at will. This is their secret — a branch of a thistle was covered with Brown Ants and Plant Lice. I observed the latter for some time, so as to discover, if possible, the moment when they caused this secretion to issue from their bodies; but I remarked that it very rarely came out of its own accord, and that the Plant Lice,

which were at some distance from the ants, squirted it out with a movement resembling a kick.

"How did it happen, then, that the ants wandering about on the thistle were nearly all remarkable for the size of their abdomens, and were evidently full of some liquid? This I discovered by narrowly watching one ant, whose proceeding I am going to describe minutely. I saw it at first passing, without stopping, over some Plant Lice, which did not seem in the least disturbed by its walking over them; but it soon stopped close to one of the smallest, which it seemed to coax with its antennæ, touching the extremity of its abdomen very rapidly, first with one of its antennæ, and then with the other. I saw with surprise the liquid come out of the body of the Plant Louse, and the ant forthwith seize upon the droplet, and convey it to its mouth. It then brought its antennæ to bear upon another Plant Louse much larger than the first: this one, caressed in the same manner, yielded the nourishing fluid from its body in a much larger dose. The ant advanced and took possession of it. It then passed to a third, which it cajoled as it had the preceding ones, giving it many little strokes with its antennæ near the hinder extremity of the body; the liquid came out immediately, and the ant picked it up. A small number of these repasts are sufficient to satisfy the ant's appetite.

"It does not appear that it is out of opportunity that these insects obtain their nourishment from the Plant Louse.

"The neighborhood of ants is agreeable to Plant Lice; since those which could get out of the way of their visits, viz., the Winged Plant Lice, prefer to remain amongst them, and to lavish upon them the superabundance of their nourishment."

The third family of the Homopterous Hemiptera (Gallinsecta) is composed of the genus

Coccus.—Scale Insects. The males are destitute of a proboscis, and have only two wings, which shut horizontally upon the body. The females are without wings, but are furnished with a proboscis. Many of the species are very injurious to trees, puncturing the bark, and causing a too abundant overflowing of the sap, which occasions those warty appearances which are often seen on many kinds of trees. Several of the species are valuable in a commercial point of view. An East Indian species produces the gum *lac*, and another is employed in China for the manufacture of wax tapers.

C. Illicis lives on a small oak in the south of Europe, and was formerly used as a dye; it is still employed in medicine.

C. Polonicus, found in Poland, lives upon the roots of the *scleranthus perennis*, and was also once valued for its coloring qualities.

C. Cacti.—This species exceeds all others in importance, inasmuch as it furnishes the cochineal of commerce, and constitutes one of the chief riches of Mexico. The female is of a dark-brown color, covered with a white down. The male is of a dark-red, with white wings.

These insects are rather remarkable, in that the male and female are so unlike, that one would take them for animals of different genera.

The male presents an elongated, depressed body, of a dark-brown red. Its head, small, furnished with two long, feathery antennæ, has only a rudimentary beak. The abdomen is terminated by two fine hairs, longer than its body. The wings, perfectly transparent, reach beyond the extremity of its abdomen, and cross each other horizontally over its back. It is lively and active. The female presents quite a different appearance. It is, in the first place, twice as large as the male, convex above, flat below. The larvæ are born in the dried-up body of their dead mother, the skeleton of the mother serving as a cradle. The eggs are attached to the lower part of the mother's body.

"When the abdomen of the mother is empty, its lower side draws up towards the upper side, and the two together form a pretty large cavity. When the mother dies, which is not long in happening, her abdomen dries up, her skin becomes horny, and forms a sort of shell. It is in this membranous cradle that the larvæ of the cochineal insect are born. The cochineal insect in its wild state lives in the woods. But it can, without difficulty, be reared artificially.

"Every one knows that the little insect, called the cochineal, furnishes, when its body has been dried and reduced to powder, a coloring matter of a beautiful red, peculiar to itself. This circumstance has saved the cochineal from the persecution to which so many other kinds of insects have been devoted by the hand of man. In hot climates, in which the cochineal insect delights, it has been preserved, and is cultivated as an article of commerce. This is how the cochineal is reared in Mexico: An open piece of land is chosen, protected against the west wind, and of about one or two acres in extent. This is surrounded with a hedge of reeds, planted in lines, distant from each other about a yard, with cuttings of cactus at most about two feet apart. The cactus garden made, the next thing is to establish in it cochineals. With this object in view they are sought in the woods, or else the females of the cochineal insect, which are gravid, are taken off plants which have been sheltered during the winter, and placed in dozens in nests made of cocoa-nut fibres, or in little plaited baskets made of the leaves of the dwarf palm, and hung on the prickles of the cactus. These are very soon covered with young larvæ. The only thing now required to be done is to shelter them from wind and rain.

"The larvæ are changed into perfect insects, which take up their abode permanently on the branches of the cacti. The Mexicans gather them as soon as they have reached the perfect state. The harvest cannot be difficult, considering the immobility of these little creatures. When collected, the cochineals are killed, packed in wooden boxes, and sent to Europe, to be used in dyeing."

ORDER VIII. NEUROPTERA.

The fore wings of the Neuroptera are membranous, naked, transparent, and furnished with a very fine network of lines like nerves, whence the name of the order, Neuroptera—*nerve-wings*. The mouth is fitted for biting, the mandibles and maxillæ being corneous and very strong.

These insects constitute the genera *Libellula* (the Dragon-flies), the *Ephemera*, *Panorpa*, *Myrmeleon*, *Hemerobius*, *Termes*, and *Phryganea*, which again are divided into many subgenera and numerous species, as

LIBELLULA.—These insects are well known under the name of Dragon-flies. They are distinguished by their large, gauze-like wings, which enable them to fly with great swiftness in the pursuit of their prey; their varied and often brilliant colors; their slender body; large, rounded head, and great eyes.

L. Depressa.—The typical species, *L. cancellata*, are distinguished by the fine leaden-blue color of the abdomen.

L. Grandis is two and a half inches in length, is swift of flight, and skims near the surface of the water, and through the air, in the manner of swallows.

L. Virgo is of a golden-green color, with wings of blue, and sometimes of a pale-brownish yellow.

All the Dragon-flies have similar habits.

The author of "Mémoires pour servir à l'Histoire des Insectes" furnishes the following interesting facts regarding them:—

Nothing is prettier than a troop of Dragon-flies taking their sport on the side of a pond, or on the banks of a river, on a fine summer's day, when a burning sun causes their wings to shine with most vivid colors.

In the perfect state, as well as in that of the larva and the pupa, the Libellulas are carnivorous. Their rapid flight makes them expert hunters, and their enormous eyes embrace the whole horizon. They seize, while on the wing, flies and butterflies, and tear them to pieces immediately with their strong mandibles. Sometimes, the ardor of the chase leading them on far from the streams, they are met with in the fields.

The female lays her eggs in the water, from which emerge larvæ which

remind one somewhat of the form of the insect, only their body is more compact and their head flattened. The larvae and pupæ inhabit the bottom of ponds and streams, where, keeping out of sight in the mud, they seek for insects, mollusks, small fish, &c. If any prey passes within their reach, they dart forwards, like a spring, a very singular arm, which represents the under lip. It is a sort of animated mask, armed with strong, jagged pincers, and supported by strong joints, the which, taken together, is equal to the body itself. This mask acts at the same time as a lip and an arm; it seizes the prey on its passage, and conveys it to the mouth. "When any insect approaches them at a time when they are in a humor for eating," says Charles De Geer, "they shoot the mask forward very suddenly, and like a flash of lightning, and seize the insect between their two pincers; then, drawing back the mask, they bring the prey up to their mandibles, and begin to eat. I have remarked that they do not spare those of their own kind, but that they eat each other up when they can; and I have also seen them devouring very small fish which I put by them. It is very difficult for other insects to avoid their blows, because, walking along generally in the water very gently, and, as it were, with measured steps, almost in the same way a cat does on the lookout for birds, they suddenly dart forward their mask, and seize their prey instantaneously."

The respiration of these larvae is very singular. Their abdomen is terminated by appendages, which they open to allow the water to penetrate into the digestive tube, whose sides are furnished with gills communicating with the tracheæ. The water, deprived of oxygen, is then thrown out, and the larva advances thus in the water by the recoil. It has no tufts of external lateral gills, which, in the case of the Ephemerae, do the duty of fins. The pupa already presents stumps of wings. To effect its metamorphoses, it drags itself out of the water, where it has lived for nearly a year, climbs slowly to some neighboring plant, and hangs itself there. Very soon the sun dries and hardens its skin, which, all of a sudden, becomes crisp, and cracks. The Dragon-fly then sets free its head, its thorax, and its legs; its wings, still and wanting in vigor, gain strength by coming in contact with the air, and, after a few hours, they have attained their full development. Immediately the insect abandons, like a worn-out suit, the dull, slimy skin which had covered it so long, and which still preserves its shape, and dashes off in quest of prey.

EPEMERA.—The generic name of these insects, known as May-flies, indicates the short duration of their life, which, in their perfectly developed form, is limited to a day, and often to a few hours. Their larva and pupa life extends through two or three years, during which they reside in the water, where they swim with great ease, concealing themselves at times

beneath the pebbles, or in galleries which they hollow out in the beds of rivers and ponds. They feed on insects. When about to undergo their last metamorphosis, they come out of the water and attach themselves to plants. The transformation is accomplished in a few hours, when they flutter in unnumbered millions in the sunbeams, apparently in the possession of a joyous though brief existence; for they hatch their eggs at sunset, and, having fulfilled the purpose of their being, at sunrise have ceased to live.

PANORPA. — The Panorpas form a curious little group, having a peculiarly shaped head, which is prolonged to a kind of long, slender beak. They live on hedges and plants during the summer. Their bodies are slender, marked with yellow and black spots; and their wings, which are four, are also spotted with black. The abdomen of the male is terminated by a long, jointed, recurved tail, with a claw at the tip.

MYRMELEON. — The insects of this genus have the antennæ gradually thickened, curved at the tips, and much shorter than the body, and the body is long and linear. The destruction which the larvæ of several species make among the ants has given the insect the name of Ant Lion.

The larvæ of the Ant Lions live on the land, and are carnivorous. When about to undergo their transformation into pupæ, they spin for themselves a silky cocoon. The pupæ, as well as the larvæ, of these insects breathe by means of gills.

The Ant Lion is an elegant insect, resembling the dragon-fly, but is distinguished from it by its antennæ. Its larva is of a rosy, rather dirty gray, with little tufts of blackish hair on its very voluminous abdomen. Its legs are rather long and slender; the two anterior pairs of legs are directed forwards, whilst the hind legs are fixed against the body, and only permit the animal to walk backwards. These larvæ are met with in great abundance in sandy places very much exposed to the heat of the sun. There they construct for themselves a sort of funnel in the sand by describing backwards the turns of a spiral, whose diameter gradually diminishes. Their strong, square head serves them as a spade with which to throw the sand far away. They then hide themselves at the bottom of the hole, their head alone being out, and wait with patience for some insect to come near. Scarcely has the Ant Lion perceived its victim on the borders of its funnel, when it throws at it a shower of dust to alarm it, and make it fall to the bottom of the precipice, which does not fail to happen.

Then it seizes it with its sharp mandibles, and sucks its blood; after which it throws its empty skin out of the hole, and resumes the lookout. Ants especially become its prey, whence its name of Ant Lion. Towards the month of July, the larvæ make themselves a spherical cocoon, mixed with grains of sand, in which they are transformed into pupæ, which are hatched

towards the end of August. The perfect Ant Lions diffuse an odor of roses; their flight, which is weak, distinguishes them from the dragon-flies.

TERMES.—The animals constituting this group are noted for their extraordinary characteristics and habits. Like the bees and ants, they organize a kind of political society, live under established rules, keep *standing armies*, and make war, and construct fortifications, on scientific principles. As miners, masons, and architects they exhibit remarkable skill and ingenuity; and, according to Mr. Smeathman, they *form gardens for the cultivation of a minute fungus!* With this insect-people *royalty, caste, and slavery* are everlasting and immutable laws. There are three distinct ranks or orders among them, constituting a well-regulated community. These are, first, the laborers, or working insects; next, the soldiers, or fighting order, who abstain from all labor, and are about twice as long as the former, and equal in bulk to about fifteen of them; and, lastly, the winged, or perfect insects, which may be styled the nobility, or gentry, of the state; for they neither labor nor fight, being scarcely capable even of self-defence. These alone are capable of being elected kings or queens; and it has been so ordained by nature, that they emigrate within a few weeks after they are elevated to this state, and either establish new kingdoms, or perish in the space of one or two days.

The first order (the working insects) are most numerous, being in the proportion of one hundred to one of the soldiers. In this state they are about a quarter of an inch long, and twenty-five of them weigh about a grain, so that they are not so large as some of the ants.

The second order, or soldiers, have a very different form from the laborers, and have been by some authors supposed to be the males, and the former the neuters; but they are, in reality, the same insects as the foregoing, only they have undergone a change of form, and approached one degree nearer to the perfect state.

The third order, or the insect in its perfect state, varies its form still more than ever, differing, in every essential part, from the laborers and soldiers; besides which, it is now furnished with four fine, large, brownish, transparent wings, with which it is, at the time of emigration, to wing its way in search of a new settlement. The difference is, indeed, so great, that these perfect insects have not, until recently, been supposed to belong to the same community with the others, and are not to be discovered in the nest until just before the commencement of the rainy season, when they undergo the last change, which is preparative to the formation of new colonies. They are equal in bulk to two soldiers and about thirty laborers; and, with the aid of their wings, roam about for a few hours, when their wings fall off, and they become the prey of innumerable birds, reptiles, and insects. Hence

it happens, that scarcely a pair of the many millions of this unhappy race find a place of safety to fulfil the first law of nature, and lay the foundation of a new community. In this state, many fall into the neighboring waters, and are eaten with avidity by the Africans, who roast them in the manner of coffee, and find them delicate, nourishing, and wholesome.

The few fortunate pairs who survive this annual massacre and destruction, being casually found by some of the laborers, who are constantly running about on the surface of the ground, are elected kings and queens of new states. Those who are not so elected and preserved, certainly perish, and most probably in the course of the following day. By these industrious creatures, the king and queen elect are immediately protected from their innumerable enemies, by enclosing them in a chamber of clay, where the propagation of the species soon commences. Their voluntary subjects then busy themselves in constructing wooden nurseries, or apartments, solely composed of wooden materials, seemingly joined together with gums. Into these they afterwards carry the eggs produced by the queen, lodging them as fast as they can obtain them from her. Plausible reasons are given by Mr. Smeathman for the belief he entertains, that they here form a kind of garden for the cultivation of a species of microscopical mushroom; and in this belief he is supported by Mr. Konig, in his essay on the East Indian Termites, by whom also this is conjectured to be the food of the young insects.

These wonderful creatures construct works which surpass those of the bees, wasps, beavers, and other animals, as much at least as those of the most polished nations excel those of the least cultivated savages. Even with regard to man, his greatest works, the boasted pyramids, fall comparatively far short, even in size alone, of the structures raised by these insects. The laborers among them employed in this service are not a quarter of an inch in length; but the structures which they erect rise, as has already been observed, to the height of ten or twelve feet and upwards above the surface of the earth. Supposing the height of a man to be six feet, this author calculates that the buildings of these insects may be considered, relatively to their size, and that of a man, as being raised to nearly five times the height of the greatest of the Egyptian pyramids; that is, corresponding with considerably more than half a mile. It may be added, that, with respect to the interior construction, and the various members and dispositions of the parts of the buildings, they appear greatly to exceed that or any other work of human construction.

The most striking parts of these structures are the royal apartments, the nurseries, magazines of provisions, arched chambers and galleries, with their various communications; the ranges of the Gothic-shaped arches,

projected, and not formed by mere excavation, some of which are two or three feet high, but which diminish rapidly, like the arches of aisles in perspectives; the various roads, sloping staircases, and bridges, consisting of one vast arch, and constructed to shorten the distance between the several parts of the building, which would otherwise communicate only by winding passages. In some parts near Senegal, the number, magnitude, and closeness of these structures make them appear like the villages of the natives.

Authors relate many extraordinary particulars in regard to the great devastations wrought by this powerful community, which constructs covered roads, diverging in all directions from the nest, and leading to every object of plunder within their reach.

These destructive animals advance by myriads to their work under an arched incrustation of fine sand, tempered with a moisture from their body, which renders the covered way as hard as burnt clay, and effectually conceals them in their insidious employment.

Mr. Forbes, on his departure from his residence at Anjengo, to pass a few weeks at a country retirement, locked up a room containing books, drawings, and a few valuables; as he took the key with him, the servant could not enter to clean the furniture; the walls of the room were white-washed, and adorned with prints and drawings in English frames and glasses: returning home in the evening, and taking a cursory view of his cottage by candle-light, he found everything in apparently the same order as he had left it; but on a nearer inspection the next morning, he observed a number of advanced works, in various directions, towards his pictures; the glasses appeared to be uncommonly dull, and the frames covered with dust: on attempting to wipe it off, he was astonished to find the glasses fixed to the wall, not suspended in frames as he had left them, but completely surrounded by an incrustation cemented by the White Ants, who had actually eaten up the deal frames and back-boards, and the greater part of the paper, and left the glasses upheld by the incrustation, or covered way, which they had formed during their depredation. From the flat Dutch bottles, on which the drawers and boxes were placed, not having been wiped during his absence, the ants had ascended the bottles by means of the dust, eaten through the bottom of a chest, and made some progress in perforating the books and linen.

The different functions of the laborers and soldiers, or the civil and military establishments, in a community of White Ants, are illustrated by Mr. Smeathman, in an attempt to examine their nest or city. On making a breach in any part of this structure with a hoe or pickaxe, a soldier immediately appears, and walks about the breach, as if to see whether the enemy is gone, or to examine whence the attack proceeds. In a short time he is followed by two or three others, and soon afterwards by a numerous body, who

rush out as fast as the breach will permit them, their numbers increasing as long as any one continues to batter the building. During this time, they are in the most violent bustle and agitation, some being employed in beating with their forceps upon the building, so as to make a noise, which may be heard at three or four feet distance. On ceasing to disturb them, the soldiers retire, and are succeeded by the laborers, who hasten in various directions towards the breach, each with a burden of mortar in his mouth, ready tempered. Though there are millions of them, they never stop or embarrass each other; and a wall gradually arises to fill up the chasm. A soldier attends every six hundred or one thousand laborers, seemingly as a director of the works; for he never touches the mortar, either to lift or to carry it. One in particular places himself close to the wall under repair, and frequently makes the above-mentioned noise, which is constantly answered by a loud hiss from all the laborers within the dome; and at every such signal, they evidently redouble their pace, and work as fast again.

The work being completed, a renewal of the attack constantly produces the same effects. The soldiers again rush out, and then retreat, and are followed by the laborers loaded with mortar, and as active and as diligent as before. Thus the pleasure of seeing them come out to fight or work alternately, Mr. Smicathman observes, may be obtained as often as curiosity excites, or time permits; and it will certainly be found the one order never attempts to fight, nor the other to work, let the emergency be ever so great. The obstinacy of the soldiers is remarkable: they fight to the very last, disputing every inch of ground so well as often to drive away the negroes, who are without shoes, and make white people bleed plentifully through their stockings. Such is the strength of the buildings erected by these puny insects, that, when they have been raised to little more than half their height, it is the constant practice of the African wild bulls to stand as sentinels upon them, while the rest of the herd are ruminating below. When at their full height of ten or twelve feet, they are used by Europeans as lookout stations, whence they can see over the grass, which, in Africa, is, on an average, of the height of thirteen feet. But perhaps the most wonderful, and, at the same time, best authenticated, part of the history of these curious insects is, that which relates to the queen, or mother of the community, in her pregnancy.

After impregnation, a very extraordinary change begins to take place in her person, or rather in her abdomen only. It gradually increases in bulk, and at length becomes of such an enormous size as to exceed the bulk of the rest of her body fifteen hundred or two thousand times. She becomes two thousand times heavier than her consort, and exceeds twenty thousand or thirty thousand times the bulk of one of the laborers. In this state eighty

thousand eggs — for they have been counted — are protruded in twenty-four hours. They are instantly taken from her body by the attendants, — a sufficient number of whom are constantly in waiting in the royal chambers and adjacent galleries, — and carried to the nurseries, which are sometimes four or five feet distant in a straight line. Here, after they are hatched, the young are attended and provided with everything necessary until they are able to shift for themselves, and take their share in the labors of the community.

PHRYGANEÆ. — Réaumur, De Geer, and M. Pietet have thoroughly investigated this group, and contributed many interesting particulars to its natural history.

Réaumur classed them as Aquatic Moths. The soft and delicate body of the larva is protected by a case to which it clings by two hooks placed at the extremity of the abdomen. They are called by different names, in allusion to their habits; as, for instance, Case Worms, from their living in a case covered with little bits of wood or sand, which they draw after them as they go. Their scientific name, Phryganea, signifies *fagot*. The Phryganeæ, in the adult state, very much resemble moths. They approach them in having rudimentary mouths, and wings without articulations, but furnished with small hairs analogous to the scales of Lepidoptera. They may be said to form a sort of connection between the Lepidoptera and Neuroptera.

They have been called *Mouches papilionacées*, or Papilionaceous Flies. The eggs laid by the female Phryganea are enclosed in gelatinous capsules, which swell in the water and attach themselves to stones, &c. The larva has the appearance of a little worm without feet. It is soon hatched, and resembles at first a little black line, and may be easily reared in an aquarium. The operation of making the silky case which it draws after it, and which protects its abdomen, may then be observed. When it is disturbed, it retreats entirely within its case. The interior is smooth, and lined with mud; on the exterior it is fortified with stones, &c.

The *P. Rhombica* furnishes its case with bits of wood or grass. Some species arrange these bits of wood and grass in spiral, others in parallel, series.

The *P. Flavicornis* covers its dwelling with little shells. "These kinds of dress," says Réaumur, "are very pretty, but they are also excessively singular. A savage, who, instead of being covered with furs, should be covered with muskrats, moles, or other entire animals, would have on an extraordinary costume; this is, in some sort, the case of our larvæ." Other Phryganeæ employ for constructing the case, which serves them as a dwelling, sand and small pebbles, each species always employing the same materials, unless they are entirely deprived of these, and obliged to employ

others. These cases protect the larvæ against the voracity of their enemies. The larvæ have a scaly head, and the three first rings of their body are harder than the rest. They live in water, and breathe by means of branchious saes arranged on the abdomen in soft and flexible tufts. They eat everything that is presented to them—leaves, and even insects, and the larvæ of their own kind. The pupæ are motionless. They stay about a fortnight in their case, whose orifice is closed by gratings of silk, then break through the gratings, and leave their prison. In this state they swim on the water until they meet with an object to which they can attach themselves, and so get out. Then they swell till they crack their skins over the back, when the perfect insect emerges.

ORDER IX. HYMENOPTERA (Membrane-wings).

The Hymenopterous insects are furnished with four membranous, naked wings, and a mouth with mandibles, maxillæ, and two lips; the females are armed with a sting, placed at the extremity of the abdomen. They all undergo a complete metamorphosis. In their perfect state they subsist on flowers; their existence, including all their states, is limited to a year.

The order is divided into two sections—the *Terebrantia* and *Aculeata*, in the first of which is placed the great genus

ICHNEUMON.—As the Mammalian Ichneumon was supposed to destroy the crocodile by depositing its eggs in its entrails, so the Ichneumonides destroy the caterpillars of Lepidopterous insects, which are so injurious to vegetation. They deposit their eggs in or upon the bodies of naked caterpillars, or pupæ; and, when hatched, the larvæ kill their victim, and undergo their changes in its body. It is an extremely numerous family, there being not less than six thousand species.

CYNIPS.—This genus comprises several species known as Gall Insects. A globular exerescence is often observed on the leaves of the oak, called by children *Oak Apple*, and which they often eat on account of its pleasant, acid taste. This "apple" is produced by these insects, which deposit their eggs in the leaf, where they increase in size and consistence; in the mean while the exerescence grows, and becomes the temporary home of the larvæ.

C. Galla Tinctoriae produces the nutgall of commerce, which is a chief ingredient in the manufacture of black ink.

CHRYYSIS.—This genus comprises the Golden-tailed Flies, which, in the richness of their colors, rival the gorgeous hues of the humming-birds.

The second section of the Hymenoptera (the ACULEATA) contains the well-known and remarkable genus

FORMICA.—The Ants. The whole animal kingdom presents nothing so extraordinary and mysterious as the habits, instincts, intelligence, domestic character, and social polity of these diminutive creatures. Man stands awe-struck and perplexed as he contemplates their wonderful ways, plainly revealing as they do the possession of intelligence and reasoning powers, which he, in his pride and vanity, has always arrogated to himself as a peculiar inheritance. In regard to them the late Professor Godwin well remarks:—

"The history of a tribe of insects so long celebrated for their industry and frugality, and for the display of that sagacity which characterizes some of the higher orders of animals, is peculiarly calculated to occupy the attention of modern naturalists. Ants possess the remarkable peculiarity of a threefold distinction of sex—a circumstance which is met with in no other order of the animal kingdom, and which appears, as far as observation has extended, to be totally excluded from the plan of the vegetable creation. Besides the males and females, there exists an apparently intermediate order of *neuters*, which are also denominated laboring or working ants. The neuters, thus exempted from every sexual function, exercise, on the other hand, all the offices necessary for the existence and welfare of the community to which they belong. It is they who collect supplies of food, who explore the country for this purpose, and seize upon every animal substance, whether living or dead, which they can lay hold of and transport to their nest. It is they who construct every part of their dwelling-place, who attend to the hatching of the eggs, to the feeding of the young, and to their removal, as occasion may require, to different situations favorable to their growth and development; and who, both as aggressors and as defenders, fight all the battles of the commonwealth, and provide for the safety of their weaker and more passive companions. Thus all the laborious and perilous duties of the state are performed solely by this description of ants, who act the part of helots in these singularly constituted republics of insects."

The domestic life of the different species is nearly the same. The birth and rearing of the little ones, and the duties of the adults, do not differ perceptibly from each other in the various species of ants. The females live together in harmony. They lay, without ceasing to walk about, white eggs, of cylindrical form and microscopic dimensions. The workers pick them up, and carry them to special chambers. In a fortnight after the laying, the larva appears. Its body is transparent. A head and wings can be made out, but no legs; the mouth is a retractile nipple, bordered by rudimentary mandibles, into which the workers disgorge the juices they have elaborated in their stomachs; and as they lay by no provision, they

are obliged to gather each day the sugary liquids destined for the food of the larvae.

From their birth a troop of nurses is charged with the care of them. They put them out in the open air during the day. Hardly has the sun risen, when the ants, placed just under the roof, go to tell those which are beneath, by touching them with their antennæ, or shaking them with their mandibles. In a few seconds all the outlets are crowded with workers carrying out the larvae in order to place them on the top of the ant-hill, that they may be exposed to the beneficent heat of the sun. When the larvae have remained some time in the same place, their guardians move them away from the direct action of the solar rays, and put them in chambers a little way from the top of the hill, where a milder heat can still reach them.

Nothing is more amusing than to observe the shifts ants are put to in transporting objects of great size. They stumble; they tumble "head over heels;" they roll down precipices; but, in spite of all accidents, return to their task, and always accomplish it.

The tranquil inhabitants of these subterranean republics are bound together by a mutual affection in a devoted fraternity, which makes them ever ready to assist each other. They are a real Essenean or Masonic order. They all help one another as much as they can. If an ant is tired, a comrade carries it on its back. Those which are so absorbed with their work that they have no time to think of their food, are fed by their companions. When an ant is wounded, the first one who meets it renders it assistance, and carries it home. Latreille, having torn the antennæ from an ant, saw another approach the poor wounded one, and pour, with its tongue, a few drops of a yellow liquid on the bleeding wound.

Huber the younger one day took an ant's nest to populate one of those glass contrivances which he used for making his observations, and which consisted of a sort of glass bell placed over the nest. Our naturalist set at liberty one part of the ants, which fixed themselves at the foot of a neighboring chestnut tree. The rest were kept, during four months, in the apparatus; and at the end of this time Huber moved the whole into the garden, and a few ants managed to escape. Having met their old companions, who still lived at the foot of the chestnut tree, they recognized them. They were seen, in fact, all of them, to gesticulate; to caress each other mutually with their antennæ; to take each other by the mandibles, as if to embrace in token of joy; and they then reentered together the nest at the foot of the chestnut tree. Very soon they came in a crowd to look for the other ants under the bell, and in a few hours our observer's apparatus was completely evacuated by its prisoners. When an ant has discovered any rich prey, far

from enjoying it alone, like a gourmand, it invites all its companions to the feast. Community of goods and interests exists among all the members of this model society. It is the practical realization of the dream formed by certain philosophers of our day, who were only able to conceive the idea, the possibility, the project of such a community of goods and interests, which is among ants a reality.

How do these insects manage to make themselves understood in such various ways—ask for help, give advice and invitations? They must have a language of their own, or else they must communicate their impressions by their antennæ.

When an ant is hungry, and does not wish to be disturbed in its work, it tells a foraging ant as it passes by touching it with its antennæ; the latter approaches it immediately, and presents it, on the end of its tongue, some juice it has disgorged for this purpose.

The antennæ, then, are used by the ants for the purpose of making themselves understood by each other. Dr. Ebrard, who studied these insects attentively, is of opinion that they use them in the same way as a blind man does his stick, to feel their way with, for their sight is not good. The age to which ants live is not well known. It is believed that the workers live many years.

Ants are also very fond of a peculiar liquid which the plant lice secrete from a pouch in the abdomen. When they have got possession of a plant louse, they excite it to secrete this liquid, but without doing it any harm. They carry the plant lice into the ant-hill, or into private stables. There they keep them, give them their food, and suck them. We have already mentioned these curious relations which are established between ants and plant lice. The Gallinsecta also furnish the ants with sugary liquids.

During the cold of winter the ants sleep at the bottom of their nests, without taking any food. A small number of species only hold out through the severe season by shutting themselves up in the ant-hill with a number of plant lice. It is thus that they pass the winter with a supply of food. We must mention, however, that in warm countries the ants do not hibernate.

THE ANTS AS SOLDIERS.—“Two species,” says a pleasing author, “constitute the warrior tribes which form societies mixed with the species they reduce to slavery. They are the Russet Ant and the Blood-red Ant. They always attack the nests of the Ashy-black (*Formica fusca*) and the Miners. The Russet Ant has mandibles made for war; they appear cut out for struggling and fighting. The Blood-red Ants are less ferocious. They work themselves, and make none of those sweeping raids by which the Russet Ants depopulate the neighboring ant-hills.”

"On the 17th of June, 1804," says he, "as I was walking in the environs of Geneva, between four and five in the afternoon, I saw at my feet a legion of largish Russet Ants crossing the road; they penetrated through a very thick hedge, and went into a meadow, whither I followed them. They wound their way along the turf without straying, and their column remained always continuous, in spite of the obstacles which they had to surmount. Very soon they arrived near a nest of Ashy-black Ants, whose dome rose among the grass, at twenty paces from the hedge. A few ants of this species were at the door of their habitation. As soon as they despaired the army which was approaching, they threw themselves on those which were at the head of the cohort. The alarm spread at the same instant in the interior of the nest, and their companions rushed out in crowds from all the subterranean passages. The Russet Ants, the body of whose army was only two paces distant, hastened to arrive at the foot of the nest; the whole troop precipitated itself forward at the same time, and knocked the Ashy-black Ants head over heels, who, after a very short but very smart combat, retired to the extremity of the habitation. The Russet Ants clambered up the sides of the hillock, flocked to the summit, and introduced themselves in great numbers into the first avenues; other groups worked with their teeth, making a lateral aperture. In this they succeeded, and the rest of the army penetrated through the breach into the besieged city. They did not make a long stay there; in three or four minutes the Russet Ants came out again in haste, by the same adits, carrying each one in its mouth a pupa or larva belonging to the conquered. They again took exactly the same road by which they had come, and followed each other in a straggling manner; their line was easily to be distinguished on the grass by the appearance which this multitude of white cocoons and larvæ, carried by as many Russet-colored Ants, presented. They passed through the hedge a second time, crossed the road, and then steered their course into a field of ripe wheat, whither, I regret to say, I was unable to follow them."

Huber adds that, having returned to the pillaged nest to examine it more closely, he saw some Ashy-black workers bringing back to their home the few larvæ which they had succeeded in saving. Having later discovered the nest of these Amazons,—which is the name he gives to the warrior ants,—he found there many of the Ashy-black Ants living on very good terms with their kidnappers.

The Amazons begin their expeditions at the end of June, during the hottest hours of the day. They come out in long files, eight or ten abreast, preceded by their scouts. These columns start at a run, in a straight line, and without feeling their way. They have no chieftain. The van is re-formed every moment.

Those who are in front do not remain there; at the end of a certain time they go and range themselves in the rear, and are replaced by those which were behind. The whole troop is thus in constant communication throughout its entire length. Rarely does the expedition divide into two bodies. Arrived under the walls of the fortress, the column halts and masses itself into one corps. The assault is made with incredible impetuosity. In the twinkling of an eye the place is escaladed, taken by storm, and pillaged, and the Ashy-black Ants are either put to flight or led away into captivity. The same ant-hill may be invaded as many as three times running on the same day; but then the Ashy-black Ants, on their guard, have barricaded themselves in, and in that case the aggressors return home without pillaging them.

The Mining Ants are less timid than the Ashy-black, and, as they defend themselves with more energy, there are frequently deadly combats, and the field of battle is left covered with heads, legs, and limbs scattered about, here and there, with the dead and wounded. The Miners pursue the pillagers, and snatch their plunder from them. But they are sometimes driven back vigorously, and the Russet Ants gain their lair with their plunder.

The tactics of the Red Ants (*Formica sanguinea*) differ from those of the Russet. They only sally forth in small detachments, which begin by engaging in skirmishes with the scouts thrown out round the enemy's ant-hill. Couriers, despatched from time to time to the camp of the Red Ants, bring up reënforcements. When the troop feels itself sufficiently strong, it invades the nest of the Ashy-black Ants, and carries off their offspring, which the latter have not had time to secure. Sometimes, also, the Red Ants install themselves in the nest whose inhabitants they have ejected, and transfer their own population to it. The motive for this emigration is, that the old nest has become useless, or that it is exposed to some danger. The Red Ants are not the only ants which thus desert their birthplace. Many species abandon it likewise for analogous motives, and construct elsewhere another dwelling, to which they transport all the population of the first nest.

The species are very numerous.

VESPA.—The Wasps. These insects inhabit all lands, and may be easily distinguished by having the upper wings longitudinally folded while at rest, and a pedunculated abdomen, terminated by a concealed sting. Their larvae resemble those of the bee, and their history is also similar in many respects. They live in societies; the individuals share in common their labors and danger. In general they construct their habitations with a sort of paper, which they manufacture from vegetable fibres, agglutinated by a sort of gum. The cells, in form, are similar to those of the honey-comb, and are

often disposed in several stories. They feed on animal substances, on dead insects, ripe and saccharine fruits, fragments of which they cut off with their mandibles, and carry to their young.

V. Crabro. — The Hornet, — a large species, — and *V. vulgaris*, the common Wasp, are too well known to require a special description.

BOMBUS. — The Bumble Bee. It is difficult to conjecture how the name of this insect came to be corrupted to "*Humble Bee.*" The Bumble Bee has a robust body and very hairy, the hairs being often arranged in colored bands.

B. Lapidarius. — This is the common species of our fields and stone walls. It builds its nest under stones, or in piles of stone, constructing it of earth and moss, which the insects *card* with their hind legs. They live in societies of fifty or sixty, and sometimes of several hundred. They have a sharp and strong sting, notwithstanding which, children often hunt for their nests, to rob these poor creatures of their winter store of honey.

APIS. — The Bee family comprises a great number of species, which were all arranged by Linnaeus under the single genus *Apis*. We are obliged to pass by several groups, having only space left for a description of the most useful and remarkable member of this tribe.

A. Mellifica. — The Common Hive Bee. We are indebted to Huber for a great number of most interesting facts hitherto not noticed, and Cuvier, Réaumur, and De Geer have added many important particulars to the natural history of this insect. It was well known to the ancients, and its praise is celebrated in the poetry of all nations. Virgil elegantly describes its habits as far as they were known at his time.

Three sorts of individuals form a community of Honey Bees, viz., the female, mother, or queen; the males, or drones; and the working bees, erroneously called *neuters*, as they are really females, although with imperfect organs. A hive consists generally of one queen, about eight hundred males, and twenty thousand working bees. The last are the smallest, having twelve joints to their antennæ, and six abdominal rings. They are armed with stings. The mandibles are spoon-shaped and indented. There is on the outside of the hind legs a smooth hollow, edged with hairs, denominated the *basket*. The queen is of a larger size, especially in the abdomen; she has a shorter sucker, and the mandibles grooved and velvet-like beneath the tip. The males, or drones, differ from both the preceding by having thirteen joints to the antennæ, a rounded head, with larger eyes, and shorter anterior feet, the two first of which are arched.

The *wax*, of which the combs are formed, is elaborated from honey. The pollen collected from flowers, mixed with a small quantity of wax, constitutes the food of bees and their larvæ; and this food appears to be modified

in its composition according to the sort of individuals it is intended for. Another substance collected by bees from the opening buds of poplar and other trees, and used by them for lining their hives and stopping holes, is called *propolis*.

The working bees, according to Huber, are of two kinds — one whose duty it is to gather the food and materials for the hive; the other, composed of smaller and feebler insects, which are employed exclusively in the care of the young within the hive.

The comb is always built from above downwards. The cells, with the exception of those for the female larvæ and nymphs, are nearly of equal size, some containing the progeny, and others the honey and pollen of flowers. The *regal* cells are greatly superior in size, and are from two to forty in number. The season of laying commences early in summer, and continues till autumn.

The female lays as many as twenty thousand eggs in twenty-four days. Each sort of egg she places in the appropriate cell. The eggs laid at the beginning of summer all belong to the working sort, and are hatched in four days. The larvæ are regularly fed by the workers for about seven days, when they are enclosed in their cell, spin a cocoon, and become nymphs; they become perfect bees in about twelve days. These consecutive generations form so many distinct communities, which leave the parent hive to found new colonies elsewhere. This operation is called *swarming*, at which time the community, including the queen, appears to be seized with a kind of delirium, and the bees execute a number of extraordinary manœuvres before the colonization is fully effected.

A swarm of bees weighs about eight pounds.

The honey which fills the store cells is intended for daily consumption, and also as a reserve for the period when the flowers furnish no more.

The empty cells are left open, the workers making use of them when they want them, particularly during rainy days, which keep them at home. But the cells which contain the honey put by in reserve are closed. "They are," says Réaumur, "like so many little pots of jam or jelly, each one of which has its covering, and a very solid covering it is too."

Réaumur, the Hubers, father and son, and other observers have collected an immense mass of curious and surprising facts regarding the bees, which would fill many volumes. We must be contented with the introduction here of a few of the most striking.

THEIR MODE OF LABOR. — The exterior of a hive — we employ in part the words of M. Victor Rendre — gives the best idea of this laborious people. From morning till night all is movement and industry. Hundreds of bees are constantly arriving from the fields laden with provisions; others,

having discharged their burden, are departing for the country for a new store. Here cautious sentinels scrutinize every fresh arrival; there purveyors, in a hurry to be back at work again, stop at the entrance of the hive, where other bees unload them of their burdens; elsewhere a working bee engages in a battle with some rash intruder; at another point the workers are occupied in drawing out the dead body of one of their companions; at the same time the surveyors of the hive clear it of everything which interferes with their labors, or is prejudicial to health. The most admirable order presides over all these movements, and a most perfect division of labor is maintained.

THEY ASSIST EACH OTHER.—"When a bee meets," says Réaumur, "any of its companions who want food, and who have not had time to go and get any, it stops, erects and stretches out its trunk, so that the opening by which the honey may be taken out is a little way beyond the mandibles. It pushes the honey towards this opening. The other bees, who know well enough that it is from there they must take it, introduce the end of their trunk, and suck it up. The bee, which has not been stopped on its road, often goes to the places where other bees are working, that is, to those places where other bees are occupied, either in constructing new cells, or in polishing or bordering the cells already built; it offers them honey, as if to prevent them from being under the necessity of leaving their work to go and get it themselves."

THE QUEEN SUBDUES HER REBELLIOUS SUBJECTS BY HER ELOQUENCE.—In the process of *swarming*, the colony sets forth under a new queen, who often finds it difficult to establish her authority over the community. When the bees become violent in their mutiny, the young queen harangues them in a musical speech, which has the effect to stop the wild commotion, and compel the rebels reverently to bow their heads before her. The song resembles that of the grasshopper. Francis Huber, speaking of a queen which had just been hatched, and which was trying in vain to satisfy her jealous instincts, says,—

"She sang twice. When we saw her producing this sound, she was motionless; her thorax rested against the honey-comb, her wings being crossed on her back, and she moved them about without uncrossing them, and without opening them. Whatever cause it was that made her choose this attitude, the bees seemed affected by it; all of them now lowered their heads, and remained motionless. Next day the hive presented the same appearance; there remained still twenty-three royal cells, which were all assiduously guarded by a great number of bees. The moment the queen approached these, all the guards were in a state of agitation, surrounded her, bit her, hustled her in every way, and generally finished by driving her

off. Sometimes, when this happened, she sang, resuming the attitude which I just now described; from that moment the bees became motionless. But the fever which had seized on the young queen ended by communicating itself to her subjects, and, at a particular moment, they set out under her guidance."

THE QUEENS AS DUELLISTS.—When the emigration is effected, the workers which had remained at home set free another female. This one acts in the same way as the first. She tries to get at her rivals still imprisoned, and whom she can smell in their cradles; but the guard repel her with vigor, and defeat all her attempts, till she makes up her mind to emigrate with a new swarm. This curious scene is repeated, with the same circumstances, three or four times in the space of a fortnight, if the weather is favorable, and the hive well-peopled. In the end, the number of bees is so much reduced, that they can no longer keep such vigilant guard round the royal cells, and it then happens that two females come out together from their cradles. Immediately the two rivals look for each other, and fight, and the queen that comes off victorious out of this duel to the death reigns peaceably over the people she has won for herself. If, in the tumult which precedes the swarming, a female escapes from her prison, it may happen that she is carried away in the swarm. In this case the deserters divide into two bands; but the weakest in numbers are not long in breaking up, the deserters going to swell the principal swarm. At last all the troop is reunited, and it then contains two queens. As long as the swarm remains fixed on its branch, all passes quietly in spite of the presence of a second queen. But as soon as it has become domiciled, the affair becomes serious; a duel to the death takes place between the two aspirants to the command. Two queens cannot exist in the same hive.

Francis Huber was the first to describe these duels between the queens. He describes a combat which he watched on the 12th of May, 1790: "Two young queens came out on that day from the cells, almost at the same moment, in one of our smallest hives. As soon as they saw each other, they dashed one against the other with every appearance of the greatest rage, and put themselves in such a position that each one had its antennæ seized between the teeth of its rival; the head, the thorax, and abdomen of the one were opposite to the head, the thorax, and abdomen of the other; they had only to bend round the posterior extremity of their bodies, and they would have stabbed each other with their darts, and both engaged in the combat would have been killed. But it is as if Nature would not allow this duel to end by the death of the combatants. One would say that she had ordained that those queens, finding themselves in this position (that is to say, face to face and abdomen to abdomen), should retreat that very

instant with the greatest precipitation. And so, as soon as the two rivals felt that their posterior parts were about to meet, they let go of each other, and each one ran away in an opposite direction. A few minutes after they had separated from each other, their fear ceased, and they recommenced looking for each other. Very soon they perceived the object of their search, and we saw them running one against the other. They seized each other as at the first, and put themselves exactly in the same position. The result was the same; as soon as their abdomens approached each other, they only thought of getting free, and ran away.

"The working bees were very much agitated during the whole of this time, and their tumult seemed to increase when the adversaries separated from each other. We saw them on two different occasions stop the queens in their flight, seize them by the legs, and keep them prisoners for more than a minute. At last, in a third attack, the queen which was the most infuriated, or the strongest, rushed upon her rival at a moment when she did not see her coming, seized her with her jaws by the base of her wing, then mounted on to her body, and brought the extremity of her abdomen over the last rings of her enemy, whom she was then able to pierce with her sting very easily. She then let go the wing which she held between her teeth, and drew back her dart. The vanquished queen dragged herself heavily along, lost her strength, and expired soon afterwards."

EXECUTION OF THE DRONES.—The drones (that is to say, the males) are now no longer wanted in the colony; their mission is over. By an inexorable law of nature, they must be got rid of, and the working bees proceed to make a general massacre of them. It is in the months of July and August that this frightful carnage takes place. The workers may then be seen furiously giving chase to the males, and pursuing them to the extremity of the hive, where these unfortunate insects seek a place of safety. Three or four workers dash off in the pursuit of the male. They seize hold of him, pull him by his legs, by his wings, by his antennæ, and kill him with their stings. This pitiless massacre includes even the larvæ and pupæ of the males. The executioners drag them from their cells, run them through with their stings, greedily suck the liquids contained in their bodies, and then cast their remains to the winds.

This slaughter goes on for many days, continuing till the males have been completely got rid of, they not being able to defend themselves, as they have no stings.

THE BEES REASON.—Francis Huber relates that he saw bees propping up with pillars and flying buttresses of wax a piece of the honey-comb which had fallen down. At the same time, put on their guard by this sad accident, they set to work to fortify the principal framework of the other combs,

and to fasten them more securely to the roof of the hive. This took place in the month of January, and, therefore, not during the working season, and when to provide against a distant eventuality was the only question. M. Walond has reported an analogous observation. Is there not here, in the first place, a true and excellent reasoning, then an act, an operation, a work executed as the result of this reasoning? Now, an operation which is performed as the result of reasoning is attributable to intelligence. Again, the bees give different sorts of food to the different sort of larvæ. They know how to change this food when an accident has deprived the hive of its queen, and it is necessary to replace her: this is another proof of intelligence.

"But it is, above all, in the face of an enemy that the intellectual faculties of these insects show themselves. There are always at the entrance of every hive three or four bees, which have nothing else to do but to guard the door, to keep a watch over incomers and outgoers, and to prevent an enemy or an intruder from slipping into the community. When one of them perceives an enemy on the borders of the hive, it dashes forwards towards it, and, by a menacing and significant buzzing, warns it to retire. If it does not understand the warning, which is a rare occurrence,—for men, horses, dogs, and animals of all kinds know perfectly well the danger to which they expose themselves by approaching too near to a hive in full operation,—the bee gets a reënforcement, and very soon returns to the combat with a determined battalion. All this is, it seems to us, intelligence."

ORDER X. LEPIDOPTERA.

These insects, most of them beautiful, and many of them dressed in the most gorgeous and brilliant manner, have four wings, covered on both surfaces with small, colored scales, resembling a farinaceous powder, which come off at the slightest touch, whence the name of the order—a Greek word signifying *scale-wings*. Their proboscis is rolled up in a spiral direction between two palpi, clothed with scales or hairs, and forms the most important part of the mouth, and with which they draw up the nectar of flowers, which is their sole food. The antennæ are composed of a great number of joints.

The larvæ of these insects are those ugly and repulsive-looking creatures called *Caterpillars*. They have six scaly feet, corresponding with those of the perfect insect, besides four to ten membranous feet, of which the two last are situated at the posterior extremity of the body. Those which have only ten or twelve feet are called *Geometers*, or *Loopers*, from their peculiar mode of walking.

There are few persons who have not observed this caterpillar moving along on a twig or slender branch of shrubs, plants, and trees, and been struck by the curious operation. It seizes hold of the twig with its six fore legs, and then elevates the intermediate segments of the body into an arch, until the hind ones are brought close to the others, when it disengages its fore feet, and thrusts forward the body its full length, and then repeating the operation till the journey is ended.

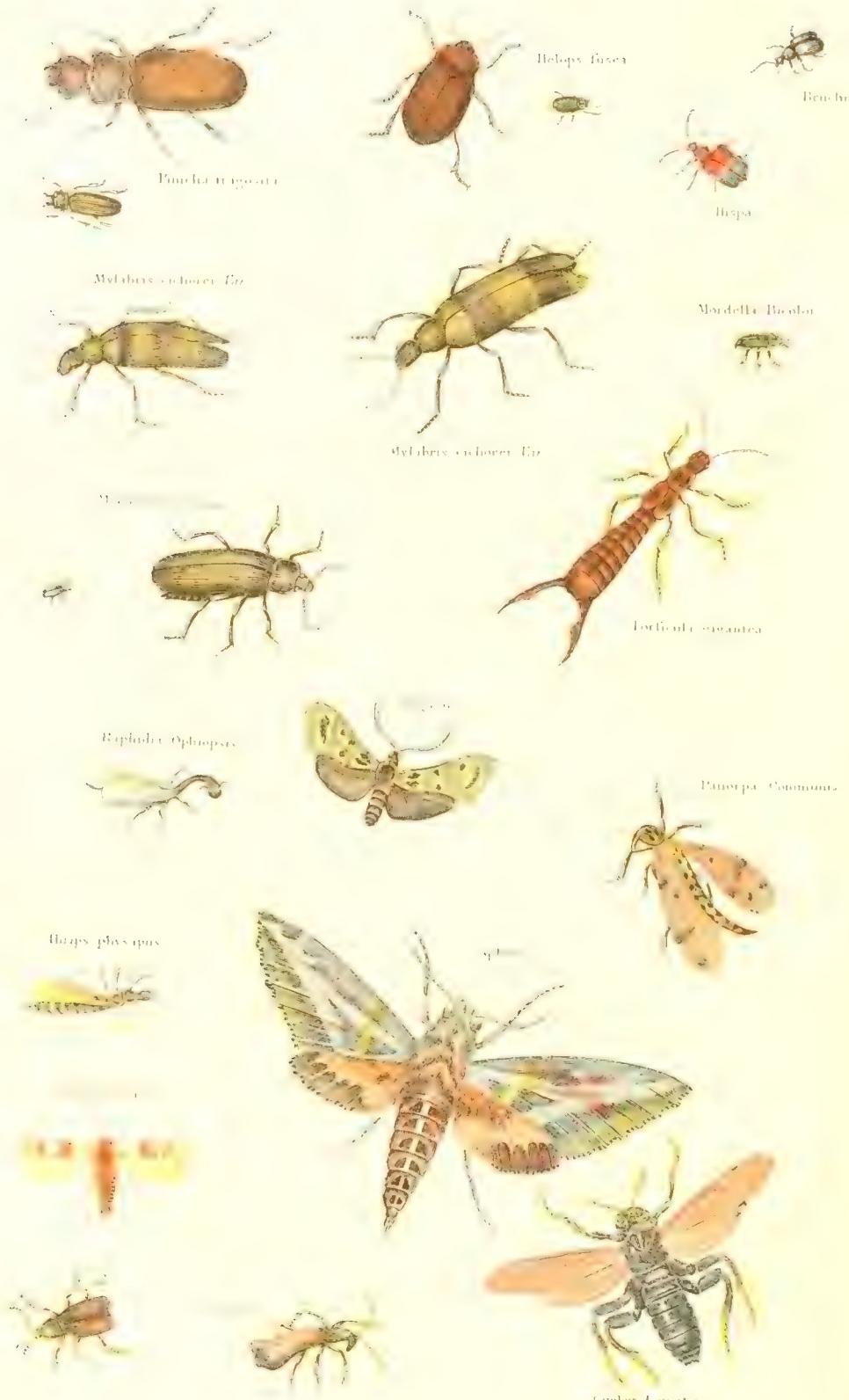
Most caterpillars are vegetable-eaters; but some feed on the hard and solid parts of wood, which they soften with a secretion discharged from the mouth, and others attack cloths and furs,—as the moths,—and do great injury. Some of the caterpillars are social, and live together under a shelter they construct together; others make cases to dwell in, and still others make galleries in the pulp of green leaves. Some of them make their appearance in winter, and we have often seen one of the moth species, in its furry coat of black and reddish-brown, moving along on a sunny bank, in the coldest weather. They generally moult four times before passing to the chrysalis state.

This order is divided by systemists into three families, and these again into many genera; but the three great genera of Linnaeus—*Papilio*, *Sphinx*, and *Thaleina*, represent the tribe with sufficient fulness for our purpose.

PAPILIO.—The Butterflies. These are diurnal insects, which delight in the sunshine, and flutter, apparently with great pleasure, through the sunny hours of the summer day. The *Papiliones* are remarkable for their beauty, and for the series of transformations they undergo before reaching the perfect state. The female lays a great quantity of eggs, which produce the caterpillars so destructive to the foliage of vegetables. After a short period the caterpillar becomes a chrysalis. These chrysalides are of various forms, and sometimes adorned with bright golden or silvery spots. Here the caterpillar closes its career, and the gorgeous and brilliant butterfly, born of its decay, comes forth in glory and splendor, the admiration and wonder of all beholders. It is not strange that this great marvel of nature should have suggested to the poetic mind of the Greeks their most expressive and eloquent symbol of immortality, viz., the *butterfly emerging from the chrysalis*.

The most splendid specimens of the genus are the *Equites*, or Knights, of Linnaeus, the most beautiful of which are found in South America, especially Brazil, where they cover the groves, gardens, and fields with their luxuriant glory.

The species are too numerous to be recorded here. *P. machaon*, or Swallow-tailed Butterfly, is a splendid insect. *P. Danai candidi* and *P.*



brassicae are the common whitish butterflies of our gardens and fields. *P. nymphalis* has the under side of the wings ornamented with silver or yellow spots on a buff ground. Among the most elegant of the family are *P. Io*, the Peacock; *P. cardui*, the Painted Lady; *P. Atalanta*, the Red Admiral; *P. iris*, the Purple Emperor; and *P. C-album*, the Common Butterfly. The chrysalis of this last bears an extraordinary resemblance to the human face.

This genus constitutes the family *Diurna* of the authors.

Another tribe of Lepidopterous insects repose during the day and night, and becomes active in the twilight of morning and evening, whence these insects are called *Crepusculariae*. They compose the genus

SPHINX.—The Sphinges have the antennae prismatic, and a distinct proboscis. They feed on leaves, and undergo their changes in the earth without weaving a web. They fly with great swiftness, hovering over flowers, with a humming sound like that of the humming-bird. The chrysalides have generally the langue-case exserted, like a nose.

S. Atropos.—The Death's-head Moth. This is one of the largest of the species, and is regarded with superstitious fear by the ignorant on account of the funereal emblem—a skull-like patch—it bears upon the back of the thorax, and the dismal cry it utters when disturbed. This noise is produced, it is supposed, by rubbing the palpi against each other.

This curious moth is not very common; the only specimen I have been able to obtain was procured at Mattapoisett, Mass., by Mr. J. C. Forbes, to whom I am indebted for it. The front wings of this insect are of a blackish-brown, varied with brown and gray above and below. On the middle of the front wing there is a distinct white dot. The hind wings have two black bands, the upper narrower than the lower one; the rest of the wing is a fine yellow. The abdomen has likewise from five to six yellow, and as many black, bands, and a long, blackish, longitudinal one in the middle.

The Death's-head Moth is very fond of honey, and consequently often steals into bee-hives, to feast on the sweet stores which the bees have acquired by their industry and skill. The poor bees are no match for this powerful enemy, whose thick skin is invulnerable to their stings, and they soon flee in consternation before it.

The members of another section of this order shun equally the glare of day and the milder glimmer of twilight, and prosecute their labors and pursue their enjoyments by night, on which account they are denominated *Nocturna*. They constitute the genus

PHALÆNA.—The Moths. These insects have the wings bridled, when at rest, by a bristle or bunch of hairs arising at the base of the outer edge

of the lower pair. The wings are horizontal, or deflexed, and sometimes rolled round the body. The antennæ gradually diminish to the tips. Some of them are destitute of a proboscis, and many of the females are without wings. The caterpillars generally spin a cocoon, and have from ten to sixteen feet; the chrysalides are always rounded. To this group belongs one of the most important and valuable animals known in the kingdom of nature, and, at the same time, it contains some of the most mischievous and destructive.

The Linnaean genus *Phalena* embraces a vast number of families and varieties, and consequently later naturalists have separated it into several sections and numerous genera, not, however, without introducing considerable confusion.

HEPIALUS (Fabricius).—The hind wings of this genus are destitute of a bridle. The caterpillars live in the earth, and eat the roots of plants. The Ghost Moth, *H. humuli*, is a well-known species. The males have silvery-white wings, and the females buff, with reddish marks.

Cossus (Fabr.).—The caterpillars of this genus live in the interior of trees, and form their cocoons of the sawdust they make. The chrysalis, immediately before undergoing its final change, works itself to the outer opening of its cell, to make its escape.

C. Ligniperda.—The Goat Moth. This is a handsome species, of a white color. Its larva is like a thick, short, red worm, and lives in the interior of various trees. When alarmed, it discharges a fetid liquor, which softens the wood.

BOMBYX.—The insects of this group have the proboscis very short; the wings are extended and horizontal, or roof-like. The larvae are exposed, and feed upon the tender parts of vegetables; they generally make a cocoon of pure silk. All the species are, more or less, silk-makers, such are the Great Atlas Moth of China, *B. cecropia*; the Great Peacock, *B. paronia major*; and the Emperor Moth, *B. paronia minor*, of Europe. *B. Neustria*, the Lackey Moth, is so named from the color of the caterpillar, which has longitudinal lines of various hues, and a blue head. Its larvae live in society, upon fruit trees, under webs of large size. They are very injurious to fruits.

B. Processionea.—The Processionary Moth. The caterpillars of this insect are also social, and often change their abode, marching in procession, one being in front, serving as a guide, followed by two, and then by three, four, five, and so on.

"I kept some for a little time in my house in the country," says Réaumur. "I brought an oak branch which was covered with them into my study, where I could much better follow the order and regularity of their march than I

could have done in the woods. I was very much amused and pleased at watching them for many days. I hung the branch on which I had brought them against one of my window shutters. When the leaves were dried up, when they had become too hard for the jaws of the caterpillars, they tried to go and seek better food elsewhere. One set himself in motion, a second followed at his tail, a third followed this one, and so on. They began to defile and march up the shutter, but being so near to each other that the head of the second touched the tail of the first. The single file was throughout continuous; it formed a perfect string of caterpillars of about two feet in length, after which the line was doubled. There two caterpillars marched abreast, but as near the one which preceded them as those who were marching in single file were to each other. After a few rows of our processionists, who were two abreast, came the rows of three abreast; after a few of these came those which were four abreast; then there were those of five, others of six, others of seven, others of eight caterpillars. This troop, so well marshalled, was led by the first. Did it halt, all the others halted: did it again begin to march, all the others set themselves in motion, and followed it with the greatest precision. . . . That which went on in my study goes on every day in the woods where these caterpillars live. . . . When it is near sunset you may see coming out of any of their nests, by the opening which is at its top, which would hardly afford space for two to come out abreast, one caterpillar. As soon as it has emerged from the nest, it is followed by many others in single file; when it has got about two feet from the nest, it makes a pause, during which those who are still in the nest continue to come out; they fall into their ranks, the battalion is formed; at last the leader sets off marching again, and all the others follow him. That which goes on in this nest passes in all the neighboring nests; all are evacuated at the same time."

But the most interesting and important member of this genus is

B. Mori.—The Silk-worm Moth. This seemingly insignificant insect has now become one of the most important to man of all domestic animals. It was originally a native of China, and the neighboring parts of Asia, and was there bred and domesticated for a long time before it was known in Europe. Now, the manufacture of silk is one of the most important sources of wealth to many parts of that continent. At first, silk stuffs were sold for their weight in gold; but they are now comparatively cheap. The Silk-worm is a caterpillar, which, in due time, undergoes its metamorphoses, and becomes a moth, like others of the genus. At birth, and for the first ten days, the color of the worm is blackish or obscure. As it grows, it casts its skin at stated periods, and turns whitish or bluish, and, when ready to spin, becomes yellow. It is covered with scattering hairs, and has a little

fleshy tubercle on the upper part of the last ring. It feeds on the mulberry. Before spinning, it fasts for thirty-six hours, voids all its excrements, becomes soft and flaccid, and seeks a suitable place for the construction of its cocoon. Two or three days are occupied in this work; and the thread is stated by Count Dandolo to be sometimes six hundred and twenty-five yards in length. The worm then changes to a chrysalis, and, after remaining twenty days, the moth comes out, forcing its way through the cocoon. The males first appear, and are very brisk in their motions, but do not fly, at least in cold climates. They live but a few days, and the females perish also as soon as they have deposited their eggs. The eggs are attached, often to the number of five hundred or more, by means of a gummy substance, and hatch in the ensuing spring. The successful rearing of silk-worms is a distinct art, and requires peculiar attention. They are subject to a variety of maladies. In many places it is usual to import the eggs from some district that has acquired a reputation for their production. These are packed like grain, and are chosen much in the same manner. The eggs are in many places hatched by the human body. The silk is contained, in the form of a fluid, resembling varnish, in long, cylindrical sacks, many times the length of the animal, and capable of being unfolded by immersion in water. The fluid is easily forced out, and advantage is sometimes taken of this circumstance to procure threads much coarser than usual, which are extremely strong, and impermeable to water.

According to P. Mailla ("L'*Histoire générale de la Chine*"), the virtues of the Silk-worm were first discovered in that ancient empire. He remarks,—

"The Emperor Hoang-ti, who lived two thousand six hundred years before our era, wished that Si-ling-chi, his wife, should contribute to the happiness of his people; he charged her to study the Silk-worm, and to try to utilize its threads. Si-ling-chi caused a great quantity of these insects to be collected, which she fed herself in a place destined exclusively for the purpose; she not only discovered the means of rearing them, but, still further, the manner of winding off their silk and of employing it in the manufacture of fabrics."

Upon this statement, M. Duhalde, in his "*Description de la Chine*," thus comments:—

"Up to the time of this queen (Si-ling-chi), when the country was only lately cleared and brought into cultivation, the people employed the skins of animals as clothes. But these skins were no longer sufficient for the multitude of the inhabitants; necessity made them industrious; they applied themselves to the manufacture of cloth wherewith to cover themselves. But it was to this princess that they owed the useful invention of silk stuffs."

Afterwards, the empresses, named by Chinese authors according to the order of their dynasties, found an agreeable occupation in superintending the hatching, rearing, and feeding of silk-worms, in making silk, and working it up when made. There was an enclosure attached to the palace for the cultivation of mulberry trees.

"The empress, accompanied by queens and the greatest ladies of the court, went in state into the enclosures, and gathered with her own hand the leaves of three branches which her ladies in waiting had lowered till they were within her reach; the finest pieces of silk which she made herself, or which were made by her orders and under her own eye, were destined for the ceremony of the grand sacrifice offered to Chang-si.

"It is probable," adds Duhalde, "that policy had more to do than anything else with all this trouble taken by the empresses. Their intention was to induce, by their example, the princesses and ladies of quality, and the whole people, to rear silk-worms; in the same way as the emperors, to enoble in some sort agriculture, and to encourage the people to undertake laborious works, never failed, at the beginning of each spring, to guide the plough in person, and with great state to plough up a few furrows, and there sow some seed.

"As far as concerns the empresses, it is a long time since they have ceased to apply themselves to the manufacture of silk; one sees, nevertheless, in the precincts of the imperial palace, a large space covered with houses, the road leading to which is still called the road which leads to the place destined for the rearing of silk-worms for the amusement of the empresses and queens. In the books of the philosopher Mencius is a wise police rule, made under the first reigns, which determines the space destined for the cultivation of mulberry trees, according to the extent of the land possessed by each private individual."

Silk commanded for centuries a prodigiously high price. In the time of Alexander its value in Greece was exactly its own weight in gold, and so it was very parsimoniously employed in silk tissues. These were so transparent that women who wore them were scarcely covered.

Silk was unknown to the Romans before Julius Cæsar. It was to him that Rome owed its acquaintance with this new material. He introduced it, moreover, in a singularly magnificent manner. One day, at a fête given in the Coliseum,—a combat of animals and gladiators,—the people saw the coarse tent of cloth, intended to keep off the rays of the sun, replaced by a magnificent covering of Oriental silk. They murmured at this gorgeous prodigality, but declared Cæsar a great man. The introduction of silk among the Romans was the signal for luxurious expenditure. The patricians made a great display with their silk cloaks of incalculable value; so

that, from the time of Tiberius, the senate felt itself called upon to forbid the use of silk garments to men. Examples of simplicity are sometimes set in high places; thus the Emperor Aurelian refused to the Empress Severina a dress so costly.

As one of the most useful animals to man is found in the preceding group, so one of the most mischievous constitutes the following genus:—

TINEA.—These insects are small, but have a remarkable power of destruction. They have a short proboscis, formed of two membranous filaments, and a very hairy head. There are several species, all having the same destructive habits—feeding on furs, clothes, woollen stuffs, and grains of wheat in granaries. These moths are a constant nuisance and pest.

T. Tapezella.—The Woollen Moth is one of the most destructive. Its caterpillar has the form of a worm, and is of a glossy whiteness, with a few hairs thinly sprinkled over it, and a gray line on its back. It is enclosed in a tube, or sheath, open at both ends, in the interior of which is a sort of tissue of wool, sometimes blue, sometimes green, sometimes red, according to the color of the stuff to which the insect attaches itself, and which it despoils. The exterior of this sheath is, on the contrary, formed of silk, made by the insect itself, of a whitish color.

The caterpillars are hardly hatched before they begin to clothe themselves. Réaumur observed one of these worms during the operation of enlarging its case. To do this it put its head out of one of the extremities of its sheath, and looked about eagerly, to the right and to the left, for those bits of wool which suited best for weaving in.

"The larva changes its place continually and very quickly. If the threads of wool which are near it are not such as it desires, it draws sometimes more than half its body out of its case to go and look for better ones farther off. If it finds a bit that pleases, the head remains fixed for an instant; it then seizes the thread with the two mandibles which are below its head, tears the bit out after redoubled efforts, and immediately carries it to the end of the tube, against which it attaches it. It repeats many times in succession a similar manœuvre, sometimes coming partly out of its tube, and then again re-entering it to fix against one of its sides a new piece of wool."

After having worked for about a minute at one end of its tube, it thinks of lengthening the other. It turns itself round in its tube with such quickness, that you would imagine that it could not have had time to do so, and would think that its tail was formed in the same way as its head, and possessed the same address in choosing and tearing out the bits of wool.

"Furthermore, when the moth, which is working at elongating its case, does not find the threads or hairs of wool to its taste within reach of its head, it changes its place. Réaumur saw this insect walking, at some speed

even, carrying with it its case. It walks on its six front legs. With the middle and hind legs it clings to the interior of its case.

"At the same time that the larva becomes longer it becomes stouter. Very soon its garment will become too narrow for it. Will it enlarge its old coat, or will it make itself a new one? Réaumur discovered that it preferred to widen its old coat.

"This is what our naturalist saw when he placed larvæ with blue cases, for instance, upon stuff of a red color. The bands, which extended in straight lines from one end of the case to the other, showed the part that had been added.

"From watching them at different times," says this admirable observer, "I find that the means which they employ is precisely that to which we should have had recourse in a similar case. We know of no other way of widening a sheath—a case of any stuff that we find too narrow — than to split it right up, and to let in a piece of the proper size between the parts which we have thus divided; we should let in a piece on each side if the shape of the tube seemed to require it. This is also exactly what our larvæ do, with an extra, and which, with them, is a necessary precaution, so as not to remain exposed whilst they are working at the enlargement of their garment. Instead of two pieces, which should each be as long as their case, they let in four, each of which is not longer than half the length of their case; and, as they never split up more than half the length of the case at the same time, it has enough stuff left in it to keep it together while this opening is being filled up."

The wools of our stuffs furnish the moths not only with clothing, but also with food. Their excrements are little grains, which are the same color as the wool they have eaten.

ORDER XI. STREPSIPTERA.

The family of *Strepsiptera*, or Twisted Wings, is composed of some very singular insects, both in structure and habits. The wings are large, membranous, divided by longitudinal nervures, and folding lengthwise, like a fan, on which account Latreille names the order *Rhipiptera*, from the Greek word *rhipis*—a fan. They are mostly parasites, living in and on other insects. The genera are *Xenos*, *Stylops*, *Elenchus*, and *Halicthophagus*.

ORDER XII. DIPTERA.

This order comprises the two-winged flies, as its name, formed from the Greek words *dis* (two) and *pteron* (wing) implies. The dipterous insects have six feet, two membranous extended wings, having beneath them two movable slender bodies, called *balancers*, which the insect moves with great rapidity. The use of these appendages is not known. Many of these insects are extremely obnoxious and hurtful both to man and beast. Some, however, make partial compensation by consuming decaying animal matter, which otherwise would infect the air.

The life of these insects, after arriving at the final state, is very brief. They all undergo a complete metamorphosis, but modified in two material ways. The larvae of many change their skin in order to undergo their transformation to pupæ, and some spin a cocoon. The larvæ of dipterous insects are destitute of feet, but some have appendages which resemble them. After passing through their various changes, and arriving at their perfect development, the Diptera spend no part of their limited life in idleness. They belong to every clime, and everywhere are disturbers of the peace, and a perpetual annoyance to all living things which are within their reach. "Besides their variety," says Figuier, "and the number of their species, they are remarkable on account of their profusion. The myriads of flies which rise from our meadows, which fly in crowds around our plants, and around every organized substance from which life has departed, some of which even infest living animals, are Diptera."

This order is divided into several families, the first of which, *Nemocera*, has the antennæ, in some, composed of from fourteen to sixteen joints, and in others of from six or nine to twelve. The body is elongated, with the head small and rounded; the eyes large; the proboscis exserted, short, and terminated by two large lips, or extended into a beak. Many of these smaller Diptera often assemble in vast armies in the air, and disport themselves in a kind of dance. They compose the genera *Culex* and *Tipula*.

CULEX.—The Gnats, Mosquitos. The body of the Gnat is long and cylindric. When in a state of repose, one of its wings is crossed over the other. They present a charming appearance when seen through a microscope, their nervures, as well as their edges, being completely covered with scales, shaped like oblong plates, and finely striated longitudinally. These scales are also found on all the segments of the body. The antennæ of the Gnat, particularly those of the male, have a fine, feathery appearance. Their eyes, covered with network, are so large that they cover nearly the whole of the head.

Réaumur tells us that the sting of the Gnat is composed of five parts. He acknowledges, however, that it is very difficult to be certain of the exact number of these parts, on account of the way in which they are united, and of their form. At the present day we know that there are six. Réaumur, as also Leuwenhoek, thought he saw two in the form of a sword-blade with three edges. These have the points reversed, and are serrated on the convex side of the bend. The prick made by so fine a point as that of the sting of the Gnat ought not to cause any pain. "The point of the finest needle," says Réaumur, "compared to the sting of the Gnat, is the same as the point of the sword compared to that of the needle." So small a wound would heal at once, were it not that it has been imbued with an irritating liquid.

This liquid may be seen to exude, under different circumstances, from the trunk of the Gnat, like a drop of very clear water.

Réaumur sometimes saw this liquid even in the trunk itself. "There is nothing better," he observes, "to prevent the bad effect of gnat bites than at once to dilute the liquid they have left in the wound with water. However small this wound may be, it will not be difficult for water to be introduced. By rubbing, it will at once be enlarged, and there is nothing to do but to wash it. I have sometimes found this remedy answer very well."

When the insect is about to change from the pupa state, it lies on the surface of the water, straightening the hind part of its body, and extending itself on the surface of the water, above which the thorax is raised. Before it has been a moment in this position, its skin splits between the two breathing trumpets, the split increasing very rapidly in length and breadth.

"It leaves," says Réaumur, "a portion of the thorax of the Gnat easily to be recognized by the freshness of its color, which is green, and different from the skin, in which it was before enveloped, uncovered.

"As soon as the slit is enlarged,—and to do so sufficiently is but the work of a moment,—the fore part of the perfect insect is not long in showing itself; and soon afterwards the head appears rising above the edges of the opening. But this moment, and those which follow, until the Gnat has entirely left its covering, are most critical, and when it is exposed to fearful danger. This insect, which lately lived in the water, is suddenly in a position in which it has nothing to fear so much as water. If it were upset on the water, and the water were to touch its thorax or body, it would be fatal. This is the way in which it acts in this critical condition: As soon as it has got out its head and thorax, it lifts them as high as it is able above the opening through which they had emerged, and then draws the posterior part of its body through the same opening; or rather that part pushes itself forward by contracting a little and then lengthening again, the roughness of the covering from which it desires to extricate itself serving as an assistance.

"A larger portion of the Gnat is thus uncovered, and, at the same time, the head is advanced farther towards the anterior end of the covering; but as it advances in this direction, it rises more and more, the anterior and posterior ends of the sheath thus becoming quite empty. The sheath then becomes a sort of boat, into which the water does not enter; and it would be fatal if it did. The water could not find a passage to the farther end, and the edges of the anterior end could not be submerged until the other was considerably sunk. The Gnat itself is the mast of its little boat. Large boats, which pass under bridges have masts which can be lowered; as soon as the boat has passed the bridge, the mast is hoisted up by degrees until it is perpendicular. The Gnat rises thus until it becomes the mast of its own little boat, and a vertical mast also.

"It is difficult to imagine how it is able to put itself in such a singular, though for it a necessary, position, and also how it can keep it. The fore part of the boat is much more loaded than the other, but it is also much broader. Any one who observes how deep the fore part of the boat is, and how near the edges of its sides are to the water, forgets, for the time being, that the Gnat is an insect that he would willingly destroy at other times. One feels uneasy for its fate; and the more so if the wind happens to rise, particularly if it disturbs the surface of the water. But one sees with pleasure that there is air enough to carry the Gnat along quickly; it is carried from side to side; it makes different voyages in the bucket in which it is borne. Though it is only a sort of boat, or rather mast, because its wings and legs are fixed close to its body, it is, perhaps, in proportion to the size of its boat, a larger sail than one would dare to put on a real vessel; one cannot help fearing that the little boat will capsize. As soon as the boat is capsized, as soon as the Gnat is laid on the surface of the water, there is no chance left for it. I have sometimes seen the water covered with Gnats which had perished thus as soon as they were born. It is, however, still more extraordinary that the Gnat is able to finish its operations. Happily they do not last long; all dangers may be passed over in a minute.

"The Gnat, after raising itself perpendicularly, draws its two front legs from the sheath, and brings them forward. It then draws out the two next. It now no longer tries to maintain its uneasy position, but leans towards the water, gets near it, and places its feet upon it; the water is a sufficiently firm and solid support for them, and is able to bear them, although burdened with the insect's body. As soon as the insect is thus on the water, it is in safety; its wings are unfolded and dried, which is done sooner than it takes to tell it; at length the Gnat is in a position to use them, and it is soon seen to fly away, particularly if one tries to catch it."

These troublesome creatures, during their season, allow us no repose.

They enter our chambers at night, and their loud humming forewarns us of the bloody attack about to be made. Our only refuge is behind a bulwark of gauze, or, in other words, mosquito-nets. In our newly-settled territories, where they most abound, the inhabitants are in the habit of driving them out with smoke. The Laplanders secure themselves from their sting by greasing the exposed parts of their body. Yet, vexatious as they are, we recognize their right to existence, and to those enjoyments which the Universal Father has provided for them.

TIPULA.—The *Tipulraiae* have the antennæ longer than the head, with from twelve to sixteen joints. The wings (although some species are apterous) are horizontal or roof-like, with but few nerves, and the feet are long and slender. They resemble the gnats, but their trunk is extremely short, terminating in two large lips; and the sucker is composed of two fibres. The species are very numerous.

T. Culiciformis.—The Straw-colored Midge. These insects are of social habit, and sometimes their immense multitudes fill the air like small clouds. They frequent streams, the borders of forests, and marshes. Their movements are rapid, and they seem to be constantly on the wing, rising and falling always in the same vertical line.

A small black species of midges, frequenting damp places, is as troublesome as the mosquito. In new and partially-settled countries, at some seasons, as in the spring and early summer, they are intolerable. Their bite is worse than the sting of the mosquito's lancet. They appear to be the most active and bite the most fiercely in the evening twilight.

T. Oleracea.—Father Longlegs. The extraordinary proportions of this insect, which is common in fields and pastures, arrest the attention of all, and children probably gave it its popular name. Father Longlegs has a considerable power of flight, but does not go far at a time, generally skimming along near the earth, or the top of the grass. Its hind legs are three times the length of the body, and serve as stilts, to enable it to pass over high blades of grass.

The second family of Diptera—the *Tanystoma* (Wide or Long Mouth)—comprises the seven following genera: *Asilus*, *Empis*, *Cyrtus*, *Bombylius*, *Anthrax*, *Leptis*, and *Dolichopus*.

ASILUS.—The insects composing this genus have the proboscis directed forward in front. They live by rapine and murder. The loud, buzzing noise they make in flying is the death-knell of innumerable flies, bumble bees, and beetles, which, with great adroitness, they catch and suck. Their larvæ live in the earth, and are there transformed into pupæ.

EMPIS.—This group resembles the foregoing, but the proboscis is either perpendicular or directed backwards. The head is rounded, nearly globular,

with the eyes greatly extended. The insects are small, and, while they are destructive to other species, have a taste for the honey of flowers.

BOMBYLIUS.—These insects have the antennæ close together, and the proboscis very long, and directed forwards. They make a loud, humming noise as they hover over flowers, the honey of which they suck up with their long proboscis. They fly with astonishing swiftness.

The Bombylii are clothed with a black and yellow fur. The feet are of a light yellow, and the wings have the edges bordered with a sinuous brown band.

ANTHRAX.—The antennæ of these insects are always very short, as is also the proboscis. They are very hairy, but less so than the preceding. They often alight on the ground, and upon walls, where the sunbeams fall, along which they are frequently seen flying. The wings, which are very large, are clothed, at least in the principal species, in a garb of mourning, sufficiently remarkable, in which the combinations of black and white are admirably diversified.

"Here," says M. Macquart, "the line which separates the two colors is straight; there it represents gradations; in other cases it is deeply sinuous. Sometimes the dark part shows transparent points, or the glassy part dark spots."

"This sombre garb, added to the velvet-black of the body, gives the Anthrax a most elegant appearance; and, while resting on the corolla of the honeysuckle and hawthorn to suck the juice, forms a most striking contrast, and sets forth its beauty no less than that of those lovely flowers."

DOLICHOPUS.—The Dolichopi are insects of a green or copper color, with long and very delicate legs. They station themselves on walls, the trunks of trees, and leaves. Some run with celerity and grace on the surface of the water.

The third family of the order—the *Tabanides*—comprises the genus

TABANUS.—The Tabani are large flies, well known for the torments they inflict upon cattle and horses, the skins of which they pierce in order to suck their blood. Cuvier describes them as having a head as wide as the thorax, nearly hemispherical, and covered, particularly in the males, by the eyes, which are generally golden-green, with purple stripes. It is only the females which bite; their sucker, enclosed in the proboscis, is armed with six lancets, with which they pierce the skin of man and beast.

T. Bovinus.—The Common Gad Fly. This species is of a blackish-brown. The palpi, the face, and the forehead are yellow; the antennæ black, with a whitish base; the thorax, covered with yellow hair, is striped with black; the posterior edges of the segments of the abdomen pale yellow; the legs yellowish, with the extremities black, and the exterior edge of the wings yellow.

These insects are of a most ferocious character, and often leave cattle which they have attacked covered with blood. Those who keep horses generally clothe them in summer with a net as a protection against these persistent and vexing foes. Even the lion himself flees in terror before an African species, which Bruce has described under the name of *Tsaltsalyia*, and Livingstone under the designation of *Tsetse Fly*. The latter affirms that, in traversing a certain region in Africa, he lost forty-three fine oxen by the bites of this fly. He remarks,—

"A most remarkable feature in the bite of the Tsetse is its perfect harmlessness in man and wild animals, and even calves so long as they continue to suck the cows. We never experienced the slightest injury from them ourselves, personally, although we lived two months in their habitat, which was in this case as sharply defined as in many others, for the south bank of the Chobe was infested by them, and the northern bank, where our cattle were placed, only fifty yards distant, contained not a single specimen. This was the more remarkable, as we often saw natives carrying over raw meat to the opposite bank with many Tsetses settled on it."

"The poison does not seem to be injected by a sting, or by ova placed beneath the skin; for, when one is allowed to feed freely on the hand, it is seen to insert the middle prong of three portions, into which the proboscis divides, somewhat deeply into the true skin. It then draws it out a little way, and it assumes a crimson color, as the mandibles come into operation. The previously shrunken belly swells out, and, if left undisturbed, the fly quietly departs when it is full. A slight itching irritation follows, but not more than in the bite of a mosquito. In the ox this same bite produces no more immediate effects than in man. It does not startle him as the Gad Fly does, but a few days afterwards the following symptoms intervene: The eye and nose begin to run; the coat stares as if the animal were cold; a swelling appears under the jaw, and sometimes at the navel; and, though the animal continues to graze, emaciation commences, accompanied with a peculiar flaccidity of the muscles, and this proceeds unchecked until, perhaps months afterwards, purging comes on, and the animal, no longer able to graze, perishes in a state of extreme exhaustion. Those which are in good condition often perish, soon after the bite is inflicted, with staggering and blindness, as if the brain were affected by it. Sudden changes of temperature produced by falls of rain seem to hasten the progress of the complaint; but, in general, the emaciation goes on uninterruptedly for months, and, do what we will, the poor animals perish miserably."

"When opened, the cellular tissue on the surface of the body beneath the skin is seen to be injected with air, as if a quantity of soap-bubbles were scattered over it, or a dishonest, awkward butcher had been trying to make

it look fat. The fat is of a greenish-yellow color, and of an oily consistency. All the muscles are flabby, and the heart often so soft that the fingers may be made to meet through it. The lungs and liver partake of the disease. The stomach and bowels are pale and empty, and the gall-bladder is distended with bile. These symptoms seem to indicate, what is probably the case, a poison in the blood, the germ of which enters when the proboscis is inserted to draw blood. The poison-germ contained in a bulb at the root of the proboscis seems capable, although very minute in quantity, of reproducing itself. The blood after death by Tsetse is very small in quantity, and scarcely stains the hands in dissection.

"The mule, ass, and goat enjoy the same immunity from the Tsetse as man and the game. Many large tribes on the Zambesi can keep no domestic animals except the goat, in consequence of the scourge existing in their country. Our children were frequently bitten, yet suffered no harm; and we saw around us numbers of zebras, buffaloes, pigs, pallahs, and other antelopes, feeding quietly in the very habitat of the Tsetse, yet as undisturbed by its bite as oxen are when they first receive the fatal poison. There is not so much difference in the natures of the horse and zebra, the buffalo and ox, the sheep and the antelope, as to afford any satisfactory explanation of the phenomenon. Is a man not as much a domestic animal as a dog?

"The curious feature in the case, that dogs perish though fed on milk, whereas the calves escape so long as they continue sucking, made us imagine that the mischief might be produced by some plant in the locality, and not by Tsetse; but Major Vardon, of the Madras army, settled that point by riding a horse up to a small hill infested by the insect, without allowing him time to graze; and, though he only remained long enough to take a view of the country and catch some specimens of Tsetse on the animal, in ten days afterwards the horse was dead."

The fifth family of Diptera—*Athericea*—comprises the genera *Syrphus*, *Œstrus*, *Conops*, and *Musca*.

SYRPHIUS.—This group is separated into a large number of subgenera, the most remarkable of which are *Syrphus* proper, *Vermilio*, and *Volucella*. The Syrphi have the abdomen narrowed from the base to the apex. Their larvæ feed solely upon aphides, which they often hold up in the air, and suck with great rapidity.

VERMILIO.—This insect has a white face; its forehead gray, bordered with black; the thorax of a yellowish-gray, with four brown stripes in the male; the abdomen light yellow, spotted with black; and the wings glassy.

The larva of the Vermilio has a thin, cylindrical body, capable of bending itself in every direction; a conical head, armed with two horny points; and

the last segment elongated, flat, elevated, and terminated by four hairy tentacles; at the sides of the fifth segment may be observed a little angle, from which projects a horny, retractile point.

It is of very singular habits. It makes a small tunnel in the sand, having a conical mouth, where it waits, like the spider, immovable. As soon as an insect falls into the hole, it raises its head, and, squeezing its prey in the folds of its body, devours it, and afterwards throws out the skin. It lives in this way for at least three years before attaining the perfect state.

VOLUCELLA.—The Volucellæ have a strong resemblance to the bumble bee. Certain kinds make use of and abuse this resemblance to introduce themselves fraudulently into its nests, and to deposit their eggs therein. When these eggs have hatched, the larvæ, which have the mouth armed with two mandibles, devour the larvæ of their hosts (the bees), which is the return they make for the hospitality they have received.

CESTRUS.—The Bot-Fly. In the whole insect world there is not a creature so mischievous as this. It is the curse of the ox, horse, sheep, deer, and other animals during the summer. These creatures have an instinctive consciousness of its approach and sinister designs, and exhibit much restlessness and alarm.

CE. Ovis.—This species deposits its eggs in the nostrils of sheep, where the larva is hatched, and immediately ascends into the frontal sinuses, attaching itself very firmly to the living membrane by two strong hooks situated at its mouth.

CE. Bovis.—This species deposits its eggs in the skin of young beeves. They are soon hatched, and the larva, or worm, pierces the skin, making a considerable hole therein, which it makes its temporary dwelling-place. The back of the afflicted animal becomes covered with lumps, like tumors, or boils, which are filled with a purulent matter, upon which the larvæ feed. When their probation in this strange abode is completed, they creep out, fall to the earth, and make their way into the ground from one to two feet.

CE. Equi.—The Bot Fly of the horse deposits its eggs upon such parts of the skin as are liable to be much licked by the animal, and thus they are conveyed to the stomach, where the heat speedily hatches the larvæ, which are so well known as Bot-worms. After fulfilling their destiny here, they pass out with the excrement, and undergo their other change in the air. Although they are not always hurtful to horses, they sometimes prove fatal.

These insects, in their perfect state, are not often seen, as they take no nourishment, and as soon as they deposit their eggs die.

CONOPS.—In this group the insects have the antennæ much longer than the head, and the last two joints form a mass, with a terminal style.

C. Rufipes.—This species experiences its transformations in the bodies of living bumble bees, escaping between the segments.

C. Calcitrans resembles the Domestic Fly: it is often seen on windows, and is very troublesome, before a rain, by its pricking bite, generally upon one's legs.

MUSCA.—The Flies. These insects have the antennæ inserted near the forehead, the palpi placed upon the proboscis, and transverse nerves to the wings.

M. Grossa.—This is the largest species known, being nearly, if not quite, the size of the bumble bee. The body is very bristly and black; the head is buff; the eyes brown; and the base of the wings reddish. It makes a loud, buzzing noise, and settles upon flowers in the woods.

M. Vomitoria is the Common Meat Fly, with a fulvous forehead, black thorax, and blue abdomen, with black marks. Its sense of smelling is very keen, and it soon finds meats which are exposed to its attacks, and covers them with its eggs.

M. Curnaria.—The Executioner Fly is rather larger than the Meat Fly. It is of a dark, metallic, green color, with a slight ash-colored down. It attacks oxen, and deposits its eggs on meat, and often in the wounds of animals.

M. Domestica.—The House Fly. This insect has an ash-colored body; the face black, and also the feet; the sides of the head yellow; and the forehead likewise yellow, with black stripes. This fly is common to all countries, invades all houses, and soils, with its dark-colored exudations, walls, ceilings, windows, mirrors, and all light-colored objects. It feeds on sweet substances and the fluids that are diffused by perspiration over the bodies of man and beast. In the early part of the season it does not bite or sting; but towards the end of summer, it becomes nearly as annoying as the mosquito.

After the *Muscides*, the remaining Diptera, composing the sixth family of the order, are all parasites—a kind of lice, living on the bodies of various animals, birds, and other insects. They are sometimes called Spider Flies; they run swiftly, and fly sidewise. They constitute the genus *Hippobosca*. *H. equina* (the Forest Fly). This insect, in some places, is very troublesome to horses, attaching itself in great numbers beneath the tail. *H. avicularia* lives on various species of birds. *H. ovina* infests sheep. Other species live on bats; one is the torment of the stag, and another makes its home on the honey-bee.

The Dipterous insects, for the most part, are a very ferocious class of creatures. They delight in blood, and live by robbery and murder; other insects, all kinds of beasts, and even man, suffer from their attacks. Yet in the great economy of Nature they are not without their use.

FOURTH DIVISION. THE RADIATA.

THESE animals, according to Cuvier, have no mesial planes, but may be variously divided into symmetrical parts, radiating from one or more axes. Their organs of motion, when they have any, are movable spines attached to the skin, or flexible papillæ, capable of inflation. Some are of distinct sexes, some bisexual, and some are produced by buds. They constitute a wonderful and mysterious order of life, situated on the outer limit of the animal kingdom, between which and the vegetable world seeming to form a connecting link. The Radiated Animals are divided into five classes: 1. *Echinodermata* (Spiny Skins); 2. *Entozoa* (Intestinal Worms), parasites dwelling in the intestines of other animals; 3. *Acalepha* (the Sea Nettles); 4. *Polypi*. These were once considered as plants. They are animals of a gelatinous substance, with a mouth and digestive organs more or less complicated. Many of them live in clusters upon branched or expanded polypidoms — i. e., *polypus houses*. Individually, they are very minute, and yet they are the most wonderful of architects, constructing vast reefs and even islands of hard rock, consisting of salts of lime, cemented by animal matter. 5. *Infusoria* (Animaleculæ). These are the most minute members of the animal world, and can only be observed by the aid of the microscope. Many of them are so vitalized, that, after having been for a considerable time dried to a powder, they will revive on being moistened.

CLASS I. THE ECHINODERMATA.

The animals of this class have a well-organized skin, a digestive system, and a kind of radiating nerves. They are arranged in two orders — those with feet, or organs answering the same purpose, constituting the first, and those destitute of these appendages, the second.

Although these animals seem to be the lowest in the order of sentient existence, yet a close inspection of their organization shows us many wonderful peculiarities, and proves to us once more that Nature has impressed the stamp of perfection as well upon her lowest and most simple creatures, as upon those that rank highest in the scale.

ORDER I. THE PEDICELLATA.

The characteristics of the order are numerous tentacula, furnished with suckers, which issue from small holes pierced in the skin, and which answer the purpose of feet, by which they move or adhere to rocks. They compose three great genera.

ASTERIAS. — The Star-fish. These animals have a body generally in the form of a five-pointed star, whence their name. Some, however, have a pentagon body, and others are with concave sides. "The framework of the body is composed of horny pieces, variously arranged." Some of the species are very common, and specimens may be picked up on our shores at any time.

The Common Star-fish has the back thickly set with tubercles, and of an orange color, and the under surface pale. It has rows of feet, or suckers, which serve as means of locomotion, and as instruments for procuring food. It is interesting, when one of these creatures is placed on its back in a plate filled with sea-water, to observe the activity which those sucking feet display. At first the Star-fish is motionless; for, offended by the rough handling it has undergone, the feet have all shrunk into the body; but soon they are seen to emerge, like so many little worms, from their holes, and to grope backwards and forwards through the water, evidently seeking the nearest ground to lay hold of. Those that reach it first immediately affix their suckers, and, by contracting, draw a portion of the body after them, so as to enable others to attach themselves, until, pulley being added to pulley, their united power is sufficient to restore the Star-fish to its natural position.

This act of volition is surely remarkable enough in so simple an animal, which scarcely possesses the rudiments of a nervous system, but the simple mechanism by which the suckers are put in motion is still more wonderful. Each of these little organs is tubular, and connected with a globular vesicle filled with an aqueous fluid, and contained within the body of the Star-fish, immediately beneath the hole from which the sucker issues. When the animal wishes to protrude its feet, each vesicle forcibly contracts, and, propelling the fluid into the corresponding sucker, causes its extension; and, when it desires to withdraw them, a contraction of the suckers drives back the fluid into the expanding vesicles. All these little bladder-like cavities are connected with vessels which communicate with a vascular circle surrounding the mouth.

The internal walls of the suckers and their vessels are furnished with vibratory cilia, and by this simple means a continual circulation of the fluid they contain goes on within them.

A. Rubens. — The Cross-fish. This species, according to Forbes, is a sworn enemy to oysters; and, as it is frequently found with one or more of its rays broken off, the fishermen fancy that it loses them in consequence of its oyster-hunting propensities; that it insinuates an arm into the incautious oyster's gape, with the intent of whipping out its prey, but that sometimes the apathetic mollusk proves more than a match for its radiate enemy, and, closing on him, holds him fast by the proffered finger; whereupon the Cross-fish, preferring amputation and freedom to captivity and dying of an oyster, like some defeated warrior, flings his arms away, glad to purchase the safety of the remaining whole by the reparable loss of a part, as it has the power of reproducing the broken rays.

"There is, however, reason to think that the Cross-fish destroys his prey in a very different manner from that just narrated; for star-fishes are not unfrequently found feeding on shell-fish, infolding their prey within their arms, and seeming to suck it out of its shell with their mouths, pouting out the lobes of the stomach, which they are able to project in the manner of a proboscis. Possibly the stomach secretes an acrid and poisonous fluid, which, by paralyzing the shell-fish, opens the way to its soft and fleshy parts."

Some of the Cross-fishes are distinguished from all others by having four rows of suckers in each of the avenues which groove the under surface of their rounded rays. In consequence of the great number of these singular organs, the under surface of a living Cross-fish presents a sight truly curious and wonderful. Hundreds of worm-like suckers, extending and contracting, coiling and feeling about, each apparently acting independently of the others, give the idea rather of an assemblage of polypi than of essential parts of one animal. They are sensitive in the extreme, for, if we touch one of those singular tubes when outstretched, all those in its neighborhood are thrown into a state of agitation; and when it shrinks from our touch, changing from a lengthy fibre to a little shrunk tubercle, some of its neighbors, as if partaking in its fears, contract themselves in like manner.

A. Rosacea. — The Rosy-feather Star. This singular species is now the only representative of the Lily Stars which adorned the bottom of the primeval seas. It has five large articulated rays, often divided into two or three branches, and both rays and disk are furnished with articulated threads.

This beautiful little creature is found in all northern seas. In swimming, the movements of its arms exactly resemble the alternating stroke given by the medusa to the liquid element, and have the same effect, causing the animal to raise itself from the bottom, and to advance back foremost, even more rapidly than the medusa. When dying, either in fresh water or in

spirits, it emits a most beautiful purple color, which tinges the liquid in which it is killed.

The *Snake Stars* are essentially distinguished from the true star-fishes by the long, serpent, or worm-like arms, which are appended to their round, depressed, urchin-like bodies. They have no true suckers with which to walk, their progression being effected with great facility by the twisting or wriggling of their arms, which are moreover in many species furnished with spines on the sides, assisting locomotion over a flat surface. These arms are very different from those of the true star-fishes, which are lobes of the animal's body, whereas the arms of the Ophiuridae are mere processes attached or superadded to the body.

The *Sand Stars* have rays of a whip-like or lizard-tail appearance, while those of the *Brittle Stars* look like so many centipedes or annelides attached at regular distances round a little sea-urchin.

Many of the Brittle Stars are extremely handsome, presenting every variety of variegation, and the most splendid displays of vivid hues arranged in beautiful patterns. Not often are two specimens found colored alike.

"The Common *Brittle Star*," says Edward Forbes, "often congregates in great numbers on the edges of scallop-banks, and I have seen a large dredge come up completely filled with them—a most curious sight, for, when the dredge was emptied, these little creatures, writhing with the strongest contortions, crept about in all directions, often flinging their arms in broken pieces around them, and their snake-like and threatening attitudes were by no means relished by the boatmen, who anxiously asked permission to shovel them overboard, superstitiously remarking that the things weren't altogether right."

A. *Fragilissima* (*Luidia Fragilissima*).—This remarkable animal measures nearly two feet across. The rays are from five to seven, and generally five times as long as the disk is broad. Above, the color is brick-red; the under surface is straw color.

"The first time I ever took one of these creatures," says Edward Forbes, "I succeeded in getting it into the boat entire. Never having seen one before, and quite unconscious of its suicidal powers, I spread it out on a rowing-bench, the better to admire its form and colors. On attempting to move it for preservation, to my horror and disappointment I found only an assemblage of rejected members. My conservative endeavors were all neutralized by its destructive exertions, and it is now badly represented in my cabinet by an armless disk and a diskless arm. Next time I went to dredge on the same spot, determined not to be cheated out of a specimen in such a way a second time, I brought with me a bucket of cold fresh water, to which article star-fishes have a great antipathy. As I expected, a *Luidia*

came up in the dredge—a most gorgeous specimen. As it does not generally break up before it is raised above the surface of the sea, cautiously and anxiously I sunk my bucket to a level with the dredge's mouth, and proceeded in the most gentle manner to introduce *Luidia* to the purer element. Whether the cold air was too much for him, or the sight of the bucket too terrific, I know not, but in a moment he proceeded to dissolve his corporation, and at every mesh of the dredge his fragments were seen escaping. In despair I grasped at the largest, and brought up the extremity of an arm with its terminating eye, the spinous eyelid of which opened and closed with something exceedingly like a wink of derision."

ECHINUS.—Sea-Urchins, Sea-Hedgehogs. The crust which covers the body of these animals is composed of calcareous matter, disposed in segments nicely fitted to each other,—a kind of mosaic,—and perforated by regular rows of holes for the membranous feet. There are also smaller holes in the crust, which, with four membranous tubes, seem to be the breathing apparatus. Where the crust is not perforated, it is armed with broad spines, articulated upon tubercles, and movable. The mouth is furnished with fine flat calcareous teeth, which, as they wear away at their cutting edges, extend by growth at the opposite extremity. They are slow walkers, and feed on small crustacea and shelled mollusks, which they seize with their feet, and crush with their powerful teeth.

E. Esculentus.—The ovaries of this species are eaten in the spring months, and have a very agreeable flavor. These Urchins are about the size of an apple, and of a violet color. Other well-known species are *E. lividus*, *E. melo*, and *E. sardicus*. These are all edible, and their size and abundance are among the striking peculiarities of the fish markets of the Mediterranean coasts.

HOLOTHURIA.—Sea-Slugs. These curious animals have an oblong body, with a leather-like covering, and an aperture at each end. They have the power to extend the body, like worms, or to blow it up in the form of a globe. The mouth is without teeth, but is surrounded by curiously branched tentacula, which the animal can, at pleasure, retract entirely.

In tropical seas, where coral reefs rise nearly to the surface, the Holothuriae, or Sea-Cucumbers, as they are sometimes called, from their resemblance to that vegetable, are very numerous, and many of them adorned with most brilliant colors, making the sea-bottom, when seen by the light of an almost vertical sun, as beautiful as a tropical garden.

Many of the species are esculent, and of a very gelatinous nature. They are caught and dried by the Malays, and great quantities are sent to market, under the name of *Tre-pang*. The Chinese are very fond of them, and use them in soups.

"The Holothuria of Raffles Bay is about six inches long and two inches thick. It forms a large cylindrical fleshy mass, almost without any outward sign of an organ, and as it creeps very slowly along is easily caught. The essential qualities of a good fisherman are great expertness in diving, and a sharp eye to distinguish the Holothurias from the similarly colored sea-bottom.

"The great Sea-Cucumber is the largest of all the known European species, and probably one of the largest *Cucumeriæ* in the world, measuring when at rest fully one foot, and capable of extending itself to the length of three. Under the influence of terror, it dismembers itself in the strangest manner. Having no arms or legs to throw off, like its relations the Luidia and the Brittle Star, it simply disgorges its viscera, and manages to live without a stomach; no doubt a much greater feat than if it contrived to live without a head. According to the late Sir James Dalrymple, the lost parts are capable of regeneration, even if the process of disgorgement went so far as to leave but an empty sac behind. Considering the facility with which the Sea-Cucumber separates itself from its digestive organs, it is the more to be wondered how it tolerates the presence of a very remarkable parasite—a fish belonging to the genus *Fierasfer*, and about six inches long. This most impudent and intrusive comrade enters the mouth of the Cucumber, and, as the stomach is too small for his reception, tears its sides, quartering himself without ceremony between the viscera and the outer skin. The reason for choosing this strange abode is as yet an enigma."

ORDER II. APODA.

The species are few, and resemble the Holothuriæ, but are destitute of feet. The principal genera are *Molpadiæ*, *Minyas*, *Priapulus*, *Lithodermis*, *Siphunculus*, *Bonellia*, and *Thalassema*.

CLASS II. ENTOZOA.

This class of parasitical animals is very extensive, and, from the difficulty of observing them, very perplexing to the naturalist. They live chiefly in the intestinal parts of other animals, and, as Cuvier well remarks, must have a use in the economy of nature with which we are quite unacquainted.

"There is scarcely one animal, especially of the vertebrated classes, which is not infested by several kinds; and those which inhabit one animal are rarely found in one of another genus. They are met with most abundantly

in the alimentary canal, and the ducts which empty their contents into it ; but they occur also in the cellular tissue, and in the parenchyma of the most closely invested viscera, such as the liver and the brain. They are most frequent in diseased states of the viscera, and they themselves occasion disease, or, at all events, annoyance ; but they occur even in healthy states. The difficulty of conceiving how they could get into places so obscure, and apparently so well protected, and the fact of their never having been found alive except in the interior of living animals, caused it for a long time to be believed that they were products of spontaneous generation. It has been found, however, by actual observation, that most of them either produce ova or living young ones, and that many of them have the sexes in different individuals." Some attain to a very large size.

The Entozoa are true parasites, and cannot assimilate matter for their own growth and nourishment unless they receive it from the body of a living animal. They have no vestige of breathing apparatus, which shows that they must receive their nourishment aerated by the breathing of the animals upon which they are parasitic. This supersedes all necessity of a circulating system ; and the traces of a nervous one are so very obscure that many naturalists have doubted its existence.

The injury which these intestinal worms occasion to the animals upon which they live, when their numbers become excessive, is well known. As is the case with all mysteries, these creatures, more especially those which inhabit the human viscera, have led to a great deal of mystification and quackery, and nostrums innumerable are recommended to the public ; nor are there wanting fabricated imitations of some of the more formidable species, usually prepared from the intestines of other animals. The best remedy for those inhabiting the human intestines appears to be animal oil, mixed with spirits of turpentine.

This class is divided into two orders, several families, and a great number of genera ; we shall, however, confine our observations to the genus *Tenia*, of the second order. This group comprises the Tape-worms, which are among the most cruel enemies of those animals in which they dwell, as they can absorb their nourishment and exhaust their substance.

The Tape-worm, one of the most stubborn worms which infest the bowels of beasts, and also of man, has its name from the broad, flat, ribbon-like appearance of each articulation, and of the whole body, which is composed of these articulations. Bremser makes two species, — *Tenia* and *Bothryoccephalus*, — both of which were formerly united in one species under the name of *Tenia*. One kind of both species appears in the human body ; namely, 1. *Tenia solium* (the Single or Long-limbed Chain-worm), in which the organs of generation are found on one side of every articulation.

It is the kind most commonly met with in Germany, France, and England. 2. *Bothryocephalus latus* (the Proper or Broad Tape-worm), in which the sexual organs are found on the flat sides of the articulations. It is met with only in Russia, Poland, Switzerland, and some parts of France; and causes little pain. Both kinds often reach the length of twenty or thirty feet, and usually only detached parts pass from the body, but not that which has the head; before this has passed away, the worm reproduces itself; and, moreover, what was formerly doubted, several Tape-worms are often met with in one intestinal canal.

"The symptoms of the Tape-worm are a peculiar sensation of pricking in the stomach, abdomen, anxiety, cramps, swoons, &c.; but all these symptoms are uncertain, and only the actual passing of pieces of the worm from the body is a certain proof its existence. The cure is difficult, and requires an experienced physician."

CLASS III. ACALEPIIA.

The Radiated Animals which find their home in the waters of the ocean, and which have perceptible vessels ramifying the pulpy substance of the body, constitute this class. They are seen swimming in all seas, and are remarkable for their transparent, gelatinous bodies, which reflect every hue as the rays of the sun fall upon them.

Swelling from almost microscopical dimensions to a diameter of two feet and upwards, the Acalephæ, in a long row of genera and species, inhabit the icy as well as the temperate and torrid seas. In them also is seen the influence of the more energetic solar light, which in the equatorial zone tinges the whole animal creation with livelier colors; for while the medusæ of our seas are generally obscure and dull as the waters in which they swim, those of the torrid zone appear in all the splendor of the azure, golden-yellow, or ruby-red tints which distinguish the birds and fishes of the tropical regions. During stormy weather their delicate squadrons, incapable of standing the shock of the wave, sink into profounder and more tranquil depths; but as soon as the winds are lulled they again appear on the smooth surface, and delight the eye of the seafarer as he traverses the equatorial ocean.

The Acalephæ are divided into two orders — *Simple* and *Hydrostatic*.

These creatures are of no direct use to man; but indirectly they render a service of the most important character. They partly nourish the colossal whale, which furnishes the oil of commerce, and millions of mollusks, which feed the mighty herring-shoals, whose capture gives employment and wealth to whole nations of fishermen.

ORDER I. ACALEPIA SIMPLICIA.

This order comprises the genera *Medusa*, *Cyanea*, *Rhizostoma*, *Astoma*, *Beroe*, and *Cestum*, which are subdivided into several sub-genera. They swim by alternate contractions and expansions of the body.

MEDUSA. — This genus has a central disk on the upper surface, something like the head of a mushroom, and sometimes called the umbrella. The margins of the umbrella, and those of the mouth in the middle of the under surface of the disk, are furnished with tentacula, very much varied in form and size.

These animals resemble a crystalline mushroom endowed with locomotive powers. The tentacles, however insignificant they may appear, are formidable weapons against all minute marine animals they come into contact with. Like those of the polypi, they are provided in many species with numberless small needles, which not only wound, but seem also to poison by the transmission of a corrosive liquid, which deprives the benumbed animal of all resistance. Several species, on being touched, produce a burning sensation, so that they have been deservedly called Sea-nettles.

They move by alternately expanding and contracting their umbrella-shaped disk, the convex upper surface of which is directed forward, while the fimbriated vessels and tentacles follow behind.

This genus embraces all those Acalephæ which have a true mouth on the under side of the disk; this mouth, however, is, in some species, a simple opening, and in others is placed on a peduncle.

CYANEA. — A central mouth and four lateral ovaries distinguish all the species of this group.

C. Aurita, a widely distributed species, has at maturity four long arms, and another species, *C. chrysaora*, has the margin of the umbrella furnished with long tentacula, and rows of brown or yellow spots, forming rays on the convex surface.

RHIZOSTOMA. — Those Acalephæ which have no central opening or mouth, and obtain their nourishment by suction through the tentacula, constitute this genus. These are common animals, often attaining a diameter of two feet, and a weight of twenty pounds. They are frequently left on sandy shores by the receding tide. They seem to be of a social nature, being met with in large congregations swimming in the same direction.

ASTOMA. — The animals of this genus have no central mouth, no ramifications of the peduncle, and no cavities for the ovaries.

BEROE. — These animals have a globular body, provided with salient ribs, extending from the centre of the upper surface to that of the under, and

are bristled with points or filaments, connected with a kind of vessel. They receive their nourishment through a large and capacious mouth. The number four plays the same important part in the umbrella and globe-shaped Acalephæ, as the number five in the construction of the star-fishes. All parts of the body are divisible by four, and radiate from a centre.

ORDER II. THE HYDROSTATICA.

The members of this order, according to Cuvier, are distinguished by one or more vessels filled with air, by means of which they keep themselves suspended in the water. Appendages exceedingly membranous and varied in their forms are attached to the air-vessels, and with these constitute the whole visible organization of the animal. The order comprises the genera *Physalia*, *Physsophora*, and *Diphyes*.

PHYSALIA.—The Physalæ have a large oblong body,—a mere air-vessel,—with an oblique and wrinkled salient crest on the upper surface. They swim or float upon the sea when smooth, the crest answering the purpose of a sail. The tentacles can be rolled together, or rapidly extended to a length of twenty feet. They employ them as a net, and, dragging them through the water, entrap small fishes, which are paralyzed by the venomous secretion of their funnel-shaped suckers, and conveyed to the numerous mouths of the compound animal, which, sucking like leeches, pump out their nutritious juices.

PHYSSOPHORA.—The members of this genus have no crest, the air-vessel is much smaller than in the preceding, and the numerous tentacula are suspended in a bunch under the air-vessel.

Sars, and other naturalists, consider these animals to be merely alternating generations of the bell-shaped Acalephæ, belonging undoubtedly to the most curious denizens of the ocean. They are composite creatures, forming a kind of social republic, in which some individuals are exclusively destined for locomotion, while others provide the colony with food, or are charged with the propagation of the species. A whole republic grows out of a larva or egg of a bell-shaped medusa, which, like a budding plant, gradually unfolds itself to this closely-united confraternity, and the latter in its turn gives birth to simple bell-shaped jelly-fishes. It has also been discovered that the delicate feathery forms of the sea-wreaths, sea-feathers, and sea-bells,—*sertulariæ*, *plumulariæ*, and *campanulariæ*,—which were formerly supposed to be polypes, proceed from medusa larvae, and in their turn bring forth perfect Acalephae.

DIPHYES.—The members of this genus are remarkable specimens of

animal organization, and so far are a puzzle to naturalists. They are always found curiously paired, one within the cavity of the other; yet they can in all cases be separated without injury to the life of either. They are gelatinous and transparent, and move like the Medusæ.

CLASS IV. POLYPI.

Most naturalists give the name of *Polypus* to certain gelatinous animals, generally shaped like little bags, the borders of which are provided with filaments, causing them to resemble those pulps which the ancients called *Polypi*. Destitute of interior organs, without eyes, lungs, or brain, without nerves, or even intestines, these animals subsist entirely by absorption. They are wholly stomach, and throw off the surplus of digestion through the mouth. When cut into a number of pieces, and each divided into particles, each separate fragment becomes a new and complete animal. They may be turned inside outward, like a glove, without their vital functions being at all impeded by the operation. Two Polypi, or two portions of the same Polypus, may be grafted together, and the united mass will continue to live as before. They are often connected together in greater or less numbers, and possess one common vitality diffused among them all; for the food taken by each contributes to the nourishment of the whole community; and yet each individual Polypus acts for itself, seeking its own sustenance, and fighting for it with the other Polypi to which it is joined. They subsist on shell aquatic animals, which they seize with their feelers, and introduce into the pouch which serves them for a stomach. Sometimes their prey is larger than themselves. During the hot weather they multiply by suckers, like vegetables, with great rapidity; but on the approach of winter they fall to the bottom of the water, where, it is said, they are protected from the cold till the return of the spring.

This class forms three orders.

ORDER I. THE CARNOSI.

The Carnosi are those fleshy animals that have the power of fixing themselves by their base, though many of them can crawl upon that base, or detach it and swim; but the motion which they most usually perform is that of expanding or retracting the tentacula, and opening and shutting the single aperture of the body. The order consists of two genera.

ACTINIA. — These Polypi have a fleshy body, frequently adorned with

very lively colors. The tentacula are arranged in several rows about the mouth, resembling the petals of a double flower, whence these animals are called "Sea Anemones." The light exercises great influence upon them, and they open or close their tentacula according to the fineness of the day, like so many real flowers. The Actiniæ are common to all seas; but in the warmer climates they grow to a larger size, and expand in all the glory and splendor of a flower-garden. They are very voracious animals, and feed apparently on whatever comes within their reach—crustacea, small fishes, and shelled mollusks, which they capture with their outspreading tentacula, and convey, with remarkable quickness, to the mouth, and thence to the stomach, ejecting the empty crusts and shells with the greatest ease.

The *A. Senilis* is found on the sands, in which it conceals itself when disturbed. It is about three inches wide, with a rough, leathery covering, of an orange color, and two rows of tentacula, adorned with a rose-colored ring.

A. Equini has a soft, finely-striated skin, of a bright purple, frequently spotted with green.

LUCERNORIA.—The *Lucernariae* are very nearly connected with the preceding group, but are of softer substance. The bell-shaped body rises from a small stem, generally found attached to sea-plants on a rocky bottom. The tentacles are arranged in tufts, at regular intervals, round the border of the disk. The crystalline body sparkles with greenish and reddish tints, and swims with considerable swiftness, by alternate contraction and expansion, whenever it desires to change its place.

ORDER II. GELATINOSI.

The animals composing this order are wholly gelatinous, with no horny, fleshy, or firm substance in the body. A simple cavity serves for a stomach. They constitute the genus

HYDRA.—Cuvier says that these Polypi are the simplest of all animals in their organization, the whole of which consists of a small gelatinous horn, beset with filaments which serve as tentacula; still they can swim, crawl, and even walk, after the manner of the Loopers, or Geometrical Caterpillars. They stir the water with their tentacula, and thus bring their prey within their reach. They love the light, which appears to affect them powerfully and agreeably. They may be multiplied indefinitely by a division of the body; but the natural reproduction is by buds, which shoot out from various parts of the parent animal, and drop off when matured. They are found in stagnant fresh water, and vary in color from green to gray.

ORDER III. CORALLIFERI.

This order includes many species which were once regarded as marine plants, but are now known to belong to the animal kingdom. The individuals are multitudinous, and so united as to form compound animals, generally fixed like plants, by a branched stem, or by simple expansions of a solid substance at the base, or in the middle of the group. All are connected in a common body, and have a general nutrition, so that whatever one eats contributes to the nourishment of the common body, thus forming a most extraordinary republic.

The Greek name *Polypidom*—house of the Polypi—is usually given to the common part of these compound animals. "These polypidoms are formed in layers by deposition, somewhat similar to the ivory of teeth; and they are of various degrees of hardness, the hind parts being composed of salts of lime, but always united by means of animal matter."

These apparently insignificant creatures, often so minute as to escape the eye of man, perform labors in the ocean depths in comparison with which the proudest and grandest monuments of human skill must be considered as nothing. They are the invisible architects which construct new islands and enlarge the boundaries of continents.

The prodigious surface over which their combined and ceaseless toil extends, ought to be taken into consideration in order to understand the important part they play in nature. They have built a barrier of reefs four hundred miles long round New Caledonia, and another which extends along the north-east coast of Australia one thousand miles in length. "This represents," says an illustrious zoölogist, "a mass in comparison with which the walls of Babylon and the Pyramids of Egypt are child's toys. And these edifices of the Polypi have been reared in the midst of the ocean wave, and in defiance of tempests which so rapidly annihilate the strongest works constructed by man." Notwithstanding their extreme minuteness, the Polypi have nevertheless, by their calcareous buildings, reacted powerfully on the crust of the terrestrial globe. They have modified it in two ways—by raising the bed of the sea, and by forming large calcareous mountains with their débris; in fact, when we examine the layers of which these are composed, we perceive that they are formed entirely of polypoids and bivalves which swarmed in the ancient oceans of the globe.

Ground to dust by the furious waves, these creatures have only here and there left a few traces to attest their presence, and serve as a light to the modern investigators of science.

Such is the opinion of Lyell, and most modern geologists. In support

of this view, it has been observed that certain lagoons are filled with a calcareous mud, evidently due to the detritus of polypoids, and that, so soon as this is dried, it exactly resembles the chalk of our ancient mountains. To the action of the waves, the chief agent in transforming polypoids and bivalves into calcareous strata, there is joined another, much less energetic it is true, but extremely curious. An observing man of genius, Mr. Darwin, relates that all around the Madrepore Islands the transparency of the water allows one to see shoals of fish, principally of the genus *Sparus*, which feed on the tips of the branched polypoids, exactly as flocks of sheep browse on the pasturage of our meadows. In order to nourish themselves with the workman, they devour along with him certain parts of his edifice; and, as these are absolutely indigestible, the result is, according to the English savant, that a part of the chalky substance which encumbers the bottom of sea in the vicinity of the Madrepore Reefs, comes from the defecations. When the *Spari* are dissected, their alimentary canal is seen filled with pure chalk.

The Madrepore Islands generally lie on an upheaval of the bed of the sea. Volcanic action begins the work, and the Polypi finish it: they bring the construction up to the level of the waves. These islands always display a peculiar configuration: they are nearly all circular, and thiere is a crater-like depression in the middle. This peculiarity seems to be owing to the fact, that the little workmen can support their vital energies better where the water, being agitated, brings them a more ample supply of nourishment. The animals in the centre, placed under different conditions, wasted and languishing, can only raise their living rampart more slowly. In the Pacific Ocean, where a tolerably large number of these islands are seen, the polypidoms reach the level of low tides, and after that the great surges raise the middle part, by casting back upon it incessantly the fragments which they tear away from the circumference. When in the lapse of years the island rises above water, the detritus of marine plants raises it still more, and the virgin soil is speedily fecundated by seeds which the winds, birds, and currents carry thither. Soon after man comes to crown the handiwork of nature by raising dwellings on the ruins of those of myriads of unseen beings. Then a king arrives, who sits proudly upon his throne, amidst this mass of skeletons of Polypi abandoned by the sea.

This order is divided into three families and a large number of genera. In the third family are found the *Pennatula*, or Sea-pens, and the *Spongia*, or Sponges.

The *Pennatula*, and other related species, are capable of locomotion by the contractions and dilatations of the fleshy parts. These are compound polypes, and are attached to a stem which sticks loosely in the sand. The Sea-pens

are phosphorescent; when stimulated or touched in one place, the light spreads upwards from one branchlet and one polypus to another, until it reaches the summit, while all the parts below remain dark. When the whole is thrown into a vase filled with fresh water, it emits sparks on all sides, affording a most beautiful spectacle.

SPONGIA.—The Sponges. These are well-known fibrous, marine bodies, whose only sentient portion, according to Cuvier, is a sort of thin gelatine, which soon dries off. The Sponges, of which we see in our museums but the naked skeleton, are endowed with a wonderful variety of shape and tint. Like the polypi and corals, they imitate every form of vegetation, and decorate the submarine grounds of the warmer seas with their fantastic shrubberies.

On examining a sponge, its centre will be found pierced with wide passages or channels, which, branching out like trees, terminate in the innumerable small oscula or pores with which its surface is covered. Dr. Grant has made the highly interesting discovery, that the latter continually imbibe water, which is expelled by the former as long as the sponge retains life. In this manner a perpetual circulation is maintained, providing the sponge with nourishing particles and oxygen, and performing the functions both of an alimentary tube and a respiratory apparatus. Thus even in the lowest stages of existence the bounty and admirable foresight of Nature appear in all their plenitude.

The propagation of the sponges is provided for in a no less wonderful manner. Their young eggs, or sporules, germinate on the sides of the canals, forming innumerable minute bud-like points. These, as they increase in size, are gradually clothed with vibratile hairs, or cilia, and finally detaching themselves, move about freely in the water, the united action of the perpetually vibrating cilia creating strong currents round their little bodies, and driving them forwards. In the open sea their wanderings continue for a short time, until, if they be not devoured on the way, they reach a place suitable for their further development, where they attach themselves forever, bidding adieu to all youthful rambles, and only desirous henceforth of leading the quiet sedentary life of their parents.

S. Communis.—The Common Sponge, so serviceable in our households, is most abundant in the Lycian Seas, the most valuable kinds of which abound "about the Gulf of Macri, along the Carian coast, and round the opposite islands. The species which live immediately along the shore near the water's edge, though often large, are worthless. These are of many colors; some, of the brightest scarlet or clear yellow, form a crust over the faces of submarine rocks; others are large and tubular, resembling Holothuriæ in form, and of a gamboge color, which soon turns to dirty brown

when taken out of the water; others again are lobed or palmate, studded with prickly points, and perforated at intervals with oscula. These grow to a considerable size, but, like the former, are useless, since their substance is full of needles of flint."

CLASS V. INFUSORIA.

Beyond the boundaries of visible animal existence the earth teems with forms of life of the most extraordinary character, and which occupy a most important place in the economy of nature. So small as to escape the scrutiny of the naked eye, and discovered only by the aid of the microscope, yet their calcareous shells, by immensity of numbers, and accumulating from century to century, form no small portion of the composition of the solid crust of the earth, and thus whole countries are built up of the remains of these microscopic creatures.

As a general thing, the Infusoria, or Animalecules, have a gelatinous body, and a very simple organization. They constitute two orders.

ORDER I. ROTIFERA.

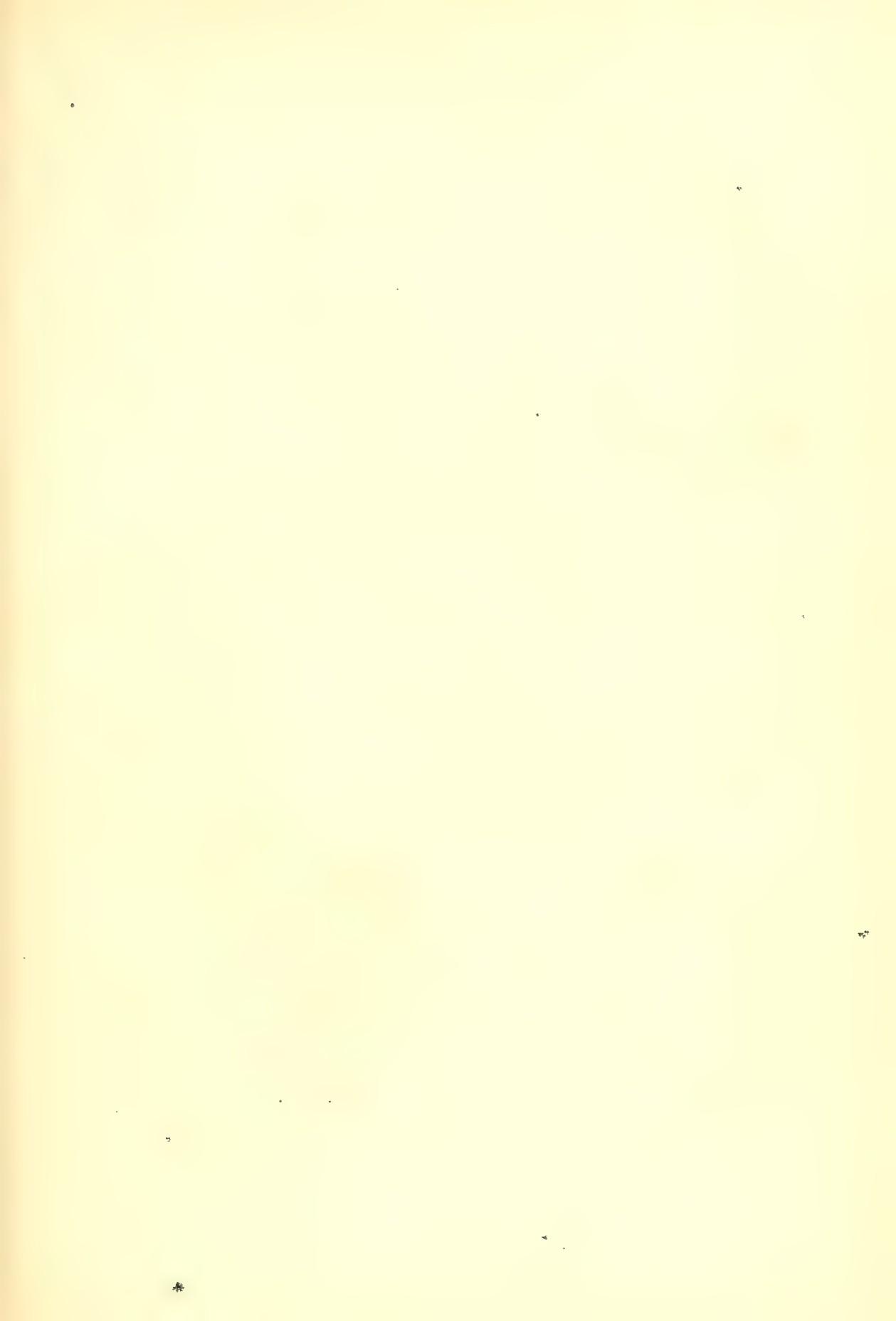
These creatures have an oval, gelatinous body, a mouth, a stomach, an intestine, and vent near the foot. They also have a tail variously formed, and on the fore part of the body an extraordinary organ, like one or more toothed wheels, which revolve with great rapidity. The genera are *Funcularia*, *Trichocerca*, *Tubicolaria*, and *Branchionus*.

The Tubicolaria form little habitations for themselves, of foreign substances, out of which they protrude the rotatory organs in a manner similar to the tentacula of Polypi.

ORDER II. HOMOGENEA.

These have no viscera, or complex organization, and many of them have no mouth. They form a considerable number of genera, all of which resemble each other in the rapidity of their movements. Those constituting the genus *Vibrio* have a round body, like a very minute thread, and are often seen in vinegar.

They move with great rapidity, darting hither and thither, in an apparently sportive mood, as we see minnows sport in their watery element.





AFRICAN

NORTH AMERICAN INDIAN

APPENDIX.

FIRST DIVISION. VERTEBRAL ANIMALS.

CLASS I. MAMMALIA.

THE reader will remember that we commenced this work with a consideration of Order II. (Quadrumana), of Class I. This was done for special reasons, of a personal character, which need not be mentioned here. Our concluding pages, therefore, will be devoted to a brief investigation of the first order of Mammalians, then omitted,—i. e., Man, and his varieties.

ORDER II. BIMANA (Two-handed).

There is a great diversity of opinion among naturalists in regard to the origin and natural history of Man. According to the older authors, he constitutes but one genus, and one single species, and has sprung from a single pair; the innumerable varieties, now existing, it is supposed, are the results of the climates through which the race has been distributed. The most eminent modern naturalists, on the contrary, affirm that man could not have descended from a single pair, but must have been created by the Almighty in nations, and in those regions of the earth where the several races find their home. According to some of these authors, the race comprises two hundred genera. We cannot here enter into this controversy, and will only remark, that however, and in whatever manner, created, the human race is still *one* in the common possession of superior and homogeneous attributes, among which is the power to aspire to the Ideal, and to recognize Religion as a supreme fact in human life.

Blumenbach, whose system of classification is the most generally adopted, reduces the several races of men to five varieties, as follows:—

I. The first variety occupies the central parts of the old continent, viz., Western Asia, Eastern and Northern Africa, Hindostan, and Europe. Its characters are the color of the skin, more or less white or brown; the cheeks tinged with red; long hair, either brown or fair; the head almost spherical; the face oval and narrow; the features moderately marked; the nose slightly arched; the mouth small; the front teeth placed perpendicularly in the jaws; the chin full and round. The Hindoos, the Abyssinians, the Berbers, or inhabitants of Mount Atlas, have features not essentially differing from those of the Europeans, except in the color of the skin, and which among the Hindoo and Abyssinian mountaineers is quite fair. This variety is called the *Caucasian*, from its supposed origin in the Caucasus. It is composed of the ruling and conquering classes.

II. The second variety is denominated the *Eastern*. The color is yellow; the hair black, stiff, and straight; the head almost square; the face large, flat, and depressed; the features indistinctly marked; the nose small and flat; the cheeks round and prominent; the chin pointed, and the eyes small. This variety comprises the Asiatics to the east of the Ganges, and of Mount Beloor, except the Malays. In Europe it embraces the Laplanders, and in America, the Esquimaux.

III. The third variety is composed of the aboriginal Americans, except the Esquimaux. There are numerous tribes, or nations, all distinguished by a copper color, stiff, straight black hair, low foreheads, sunken eyes, projecting nose, prominent cheek bones, and large face.

IV. This variety—the Malay—comprehends many of the islanders of the Pacific Ocean. The color is tawny; the hair black, soft, thick, and curled; the forehead projecting; the nose thick, wide, and flattened, and the mouth large.

V. The Negro constitutes the last variety. Its characters are,—color black; hair black and woolly; head narrow; forehead convex and arched; cheek bones projecting; nose large, and almost confounded with the upper jaw; the upper front teeth obliquely placed; the lips thick; the chin drawn in, and the legs crooked. This race is found in Western and Southern Africa, and the great islands of the Pacific Ocean, generally in the interior.

The arrangement of Blumenbach, who adds the Malayan and American races to the three admitted by Cuvier, has, as we have said, been very generally adopted; but there would seem to be quite as good reason for admitting others. Fischer, in his *Synopsis Mammalium*, indicates what he conceives to be seven species of *Homo* (reducing the number that had previously been assigned by Bory St. Vincent); and the numerous divisions and subdivi-

ions of that naturalist being tolerably in accordance with the apparent value of the character presented, whether or not they truly represent the real distinctions, or, in some instances, similarity be confounded with identity,—a problem to which philology seems to offer the only key,—the outline of his arrangement may be transferred to the present work, where it may chance to prove useful to some observers. His supposed species are as follows:—

1. *H. Japeticus*, Bory,—corresponding to the Caucasian race of Cuvier.—This is distributed under three principal varieties, termed *Caucasicus*, *Arabicus*, and *Indicus*: of these, the first is arranged into five sub-varieties, named *Caucasicus (Orientalis)*, *Pelagius (Meridionalis)*, *Celticus (Occidentalis)*, *Germanicus (Borealis)*, and *Selavonicus (Intermedius)*, which severally comprehend the Caucasic, Pelasgic, Celtic, Teutonic, and Selavonic (including the Sarmatic) nations; the second into two sub-varieties—*Atlanticus (Occidentalis)*, and *Adamieus (Orientalis)*, respectively containing the Phœnicians, ancient Numidians, and Guanches, or the Punic nations, and the Abyssinians, primitive Egyptians (modern Copts), Jews, Armenians, Arabians, &c., or the Coptic and Semitic nations.

2. *H. Neptunianus*, Bory.—Ranged under these subdivisions: the first unnamed (*Qu. Malayanus*), allied to, probably much mingled with, the Indian variety of *H. Japeticus*, and consisting of the well-known Malays, which people the coasts only of the Peninsula of Malacca, the islands of the Indian Ocean, Madagascar, &c., never penetrating inland; the second, *Occidentalis*, comprising the New Zealanders, and natives of the Society, Friendly, Sandwich, and other islands scattered over the Pacific Ocean: it is suggested, also (but with due and much required hesitation), the ancient Mexicans and Peruvians; the third, *Papuensis*, composed of certain inhabitants of part of the north coast of New Guinea, the shores of the Islands Waigou, Salwaty, Gammeau, and a few others, is obviously a hybrid race, derived from the intermixture of the Malay and true Papou. Cuvier has remarked the affinity of language subsisting between the Malays and South Sea Islanders.

3. *H. Scythicus*, Bory.—The first division of this, unnamed (*Qu. Mongolensis*), consists of the Calmucks and other Tartars; the second, *Sinicu* (*Homo sinicus* of Bory), of the Chinese, Japanese, &c.; and the third and last, *Hyperboreus* (*Homo hyperboreus*, Bory), of the Esquimaux. It corresponds to the Mongolian race of Cuvier.

4. *H. Columbicus*, Bory.—The ordinary Red Indian of America.

5. *H. Ethiopicus*, Bory.—Divided into the true Negro, not otherwise named; Caffer (*Homo Caffer*, Bory), inhabiting Caffraria, and part of the coast of Madagascar; Melanoides (*Homo melaninus*, Bory), the Papous, or

indigenous inhabitants of Madagascar, the shores of New Guinea, the islands of New Britain, New Ireland, and many others, also of Van Diemen's Land; and Hottentots (*Homo Hottentotus*, Bory), the Bush and other Hottentots, which, it may be remarked, have not a few analogies with the nomadic Mongoles. The last appear to have been much reduced and encroached on, till a remnant only is left near the south coast of Africa, just as the Celts are now confined to the extreme west of Europe.

6. *H. Polynesiensis*, Fischer (*H. Australasicus*, Bory). — The Alfurous, the lowest in the scale of human beings, comprising the inland inhabitants of the Malay Peninsular, the islands of the Indian Ocean, Madagascar, New Guinea, New Holland, &c.

THE CAUCASIAN RACE (*Homo Japeticus*, Bory).

This variety, to which we belong, is distinguished by the beauty of the oval which forms the head; and it is this one which has given rise to the most civilized nations — to those which have generally held the rest in subjection. It varies in complexion and in the color of the hair.

The name Caucasian, says Cuvier, has been affixed to the race from which we descend, because tradition and the filiation of nations seem to refer its origin to that group of mountains situate between the Caspian and Black Seas, whence it has apparently extended by radiating all around. The nations of the Caucasus, or the Circassians and Georgians, are even now considered as the handsomest on earth. The principal ramifications of this race may be distinguished by the analogies of language. The Armenian or Syrian branch, spreading southward, produced the Assyrians, the Chaldeans, the hitherto untamable Arabs, who, after Mahomet, expected to become masters of the world; the Phoenicians, the Jews, the Abyssinians, which were Arabian colonies, and most probably the Egyptians. It is from this branch, always inclined to mysticism, that have sprung the most widely-extended forms of religion. Science and literature have sometimes flourished among its nations, but always in a strange disguise and figurative style.

The Indian, German, and Pelasgic branch is much more extended, and was much earlier divided, notwithstanding which the most numerous affinities have been recognized between its four principal languages — the Sanscrit, the present sacred language of the Hindoos, and the parent of the greater number of the dialects of Hindostan; the ancient language of the Pelasgi, common parent of the Greek, Latin, many tongues that are extinct, and of all those of the south of Europe; the Gothic, or Teutonic, from which are derived the languages of the north and north-west of Europe, such as the German, Dutch, English, Danish, Swedish, and their dialects; and finally, the Sclovonian, from which are descended those of the north-east, the Prus-

sian, Polish, Bohemian, and that of the Vandals. It is by this great and venerable branch of the Caucasian stock, that philosophy, the arts and sciences, have been carried to their present state of advancement; and it has continued to be the depository of them for thirty centuries.

It was preceded in Europe by the Celts, whose tribes, once very numerous, came by the north, and are now confined to its most western extremities; and by the Cantabrians, who passed from Africa into Spain, and have become confounded with the many nations whose posterity have mingled in the peninsula.

The ancient Persians originate from the same source as the Indians; and their descendants still present a very close resemblance to the nations of Europe.

The Seythian and Tartar branch, extending first towards the north and north-east, and always wandering over the immense plains of those countries, returned but to devastate the happier abodes of their more civilized brethren. The Seythians, who, at so remote a period, made irruptions into Upper Asia; the Parthians, who there destroyed the Greek and Roman domination; the Turks, who there subverted that of the Arabs, and subjugated in Europe the unfortunate remnant of the Grecian people, were all offsets from this branch. The Finlanders and Hungarians are tribes of the same division, which have strayed among the Selavonic and Teutonic nations. Their original country, to the north and eastward of the Caspian Sea, still contains inhabitants who have the same origin, and speak similar languages; but these are mingled with many other petty nations, variously descended, and of different languages. The Tartars remained unmixed longer than the others throughout that extent of country included between the mouth of the Danube to beyond the Irtisch, from which they so long menaced Russia, and where they have been finally subjugated by her.

THE EASTERN OR MONGOLIAN RACE (*II. Scythicus*, Bory).

The Mongolian is known by its projecting cheek bones, flat visage, narrow and oblique eyebrows, scanty beard, and olive complexion. Great empires have been established by this race in China, and Japan, and its conquests have sometimes extended to this side of the Great Desert; but its civilization has always remained stationary. Its branches (the Calmucks and Kalkas), still wandering shepherds, traverse the Great Desert. Thrice did their ancestors, under Attila, Genghis, and Tamerlane, spread far the terror of their name. A third branch (the Mantchures) have recently conquered and still govern China. The Japanese, Coreans, and nearly all the hordes which extend to the north-east of Siberia, subject to Russia, are also to be considered, in a great measure, as originating from this race and such

also is deemed to be the fact with regard to the original inhabitants of various islands bordering on that archipelago. With the exception of some Chinese literati, the nations of the Mongolian race pertain generally to different sects of Buddhism, or the religion of Fo.

The origin of this great race appears to have been in the Altai Mountains, as that of ours in the Caucasus; but it is impossible to trace with the same certainty the filiation of its different branches. The history of these wandering nations is as fugitive as their establishments; and that of the Chinese, confined exclusively to their own empire, furnishes little that is satisfactory with respect to their neighbors. The affinities of their languages are also too little known to direct us in this labyrinth.

One branch of this race, although of no account in the scale of nations, yet occupying as it does so singular a geographical position, and separated from the parent stock by oceans and continents, deserves a more particular description. We refer to the Esquimaux, who are found in the northern parts of our continent. By most persons they are regarded as Indians, and are spoken of as such. But they have no characters in common with the Indians. In stature, complexion, and the position of the eyes they are entirely different. There is yet another point of difference between this people and the Indians: from Cape Farewell to Behring's Strait, the Esquimaux speak one language, and derive almost their whole subsistence from the sea; whereas the Indians never resort to fishing where they can do otherwise, and speak a great variety of dialects, even when the language of the several tribes is radically the same.

The average height of those in Greenland and the eastern part of America is beneath five feet. They are deficient in physical strength, and the muscle of even the young and strong men is not prominent or well developed. The necks of the men are small and shrivelled; those of the women are well proportioned. Distended abdomen is universal among them, but corpulence is not common. Both sexes dress alike. Their dress consists of a jacket, with a hood, a pair of breeches, which reach below the knee, and an enormous pair of boots—all of seal-skin. The jacket has one flap before and another behind, both of which hang nearly to the ground. These habiliments, doubled, or even trebled, are their protection in winter and summer. Sometimes these garments are made of other materials. The clothing of the children does not differ from that of adults. Their principal articles of food are train oil and the flesh of seals and walruses. These animals are watched for hours on the ice, and finally despatched with spears. In summer the Esquimaux kill a few reindeer, and in districts where they are found, musk oxen. They also attack and destroy the polar bear. Their only arms are spears, and bows and arrows—all or most of which weapons

are constructed of pieces of bone and fragments of wood, fastened together, and tipped with ivory. As their country produces no wood, they are compelled to resort to such means. In winter, they reside in huts made of snow, which are lighted and warmed by lamps. Their summer habitations are tents of skins, which are supported by the bones of marine animals and reindeers' horns. When they travel in winter, they transport their effects on sledges made of bone, and drawn by dogs. Procuring food is the sole duty of the men; but all other labors devolve on the women.

Both sexes are equally expert in the management of canoes, which are made of seal-skins stretched on a frame of wood or bones. One tribe of Esquimaux, discovered by Captain Ross in the south-eastern part of Baffin's Bay, have no canoes, or any means of floating, excepting on pieces of ice. The Esquimaux have the rambling propensity which distinguishes the Indians, with this difference—they prefer the most desolate and inhospitable regions. They have no settlements or fixed places of habitation; but there are several mustering points, at which they assemble at certain stated times: Igloolik, the mouth of the Coppermine, and the mouth of the Mackenzie, are some of them. There is no marriage ceremony among the Esquimaux. Children are betrothed in infancy. Bigamy is common, but a man seldom has more than one wife at a time. Sometimes they select wives for themselves. Divorces depend on the pleasure of the parties, and are very common. Children are also adopted, and the connection binds the parties as firmly as the ties of blood. They are very fond of their children, whom they never chastise or correct. This kindness is not reciprocated by the children, who abandon their parents whenever they become burdensome. The Esquimaux are superstitious, and have priests who pretend to hold intercourse with the invisible world. The gods of their worship are many. Where they have had little or no intercourse with the whites, the Esquimaux are scrupulously honest. They never touch each other's property without permission. Yet they are envious to a degree scarcely credible. The possession of any article draws on a man the ill will of all his neighbors. Gratitude is absolutely unknown to them. In sickness or danger, the husband cares not for the wife, nor the wife for the husband. Parents receive no attention in their old age, and deny their children the rights of sepulture. Selfishness is the ruling principle of the Esquimaux. Their hospitality, like that of other savages, is universal. Strangers are received in the kindest manner: every want is removed, every accommodation supplied. The good quality is balanced by a proneness to falsehood. Their lies are chiefly confined to calumnies against each other, and false accusations. This mostly prevails among the women. They are not quarrelsome, nor ferocious, nor are they cowardly. In pain, cold, starvation, disappointment, or when ill

treated, their equanimity is admirable. They seldom dispute or quarrel, and revenge is scarcely known among them. Yet they venture to sea on loose cakes of ice, and attack the polar bear without the least hesitation.

THE AMERICAN INDIAN (*H. Columbianus*, Bory).

All the Indian tribes of the American continent have the same physical characteristics. The bronze or copper color, the straight, coarse, black hair, the hazel eyes, the high-cheek bones, and erect form, are common to them all. There is, indeed, some difference in the stature of different tribes. The Osages are very tall, and the Shoshonees are below the middle stature. Each race, and indeed each tribe, has its peculiar physiognomy. To a European, or Anglo-American, all Indians look alike; but one accustomed to them can distinguish the tribes with almost unerring certainty. Thus a Daheotah is as readily distinguished from a Chippeway, or a Winnebago, by his features, as his dress. Yet the difference is not so great as to induce a belief that all the tribes are not descended from the same stock.

The Indians in the northern part of North America are divided into several great families. The Algonquin, or Chippeway, is one of the two most numerous now in existence. All the tribes of New England were Algonquins, if we may take identity of language, manners, and customs as a proof of the fact. The vocabulary of the Narraganset tongue, recorded by Roger Williams, proves them to have been a branch of the Algonquin stock. The Mohegans, considered the progenitors of the other tribes in New England, spoke the same tongue. The tribes in Maine claimed the same origin. The Delaware, or Lenni Lenape, were of the same family; and their language has been pronounced, by competent judges, the most perfect existing. The Iroquois, or Six Nations, once dreaded from the Atlantic to the Mississippi, are Algonquins. This tribe did and still does extend from the mouth of the St Lawrence to the Mississippi, and thence northward to Great Slave Lake; for so far do the Nayheeowawk, or Knisteneaux, extend their rambles.

On the western side of the Mississippi is another great Indian family, viz., the Sioux, or Daheotah. The Daheotah proper inhabit the country on the west side of the Mississippi, north of the Wisconsin, to the sources of the Mississippi. Their territory extends westward to the Missouri. This tribe speak a language radically distinct from that of the Algonquin race. Their origin is unknown, and their own traditions are at variance on this point one with another. One account, and the most probable, represents them as having been driven from the confines of Mexico by the Spaniards.

The branches of this tribe are the Winnebagoes, the Otoes, the Toways, the Missouris, the Assinniboins, the Omahaws, the Kansas, and the Osages.

All these tribes speak dialects of the Daheotah tongue. The Assinniboins are known also by the names of Ossinneboins, Ossinnepoilles, Stone Indians, and Hohays. This last is the name they give themselfes. Their secession from the Daheotah stock is recent, and its cause is as follows: One Daheotah had eloped with the wife of another, and taken refuge in the tents of his kindred. The husband, going to reclaim his spouse, was slain by the adulterer. His father and uncles, demanding blood for blood, according to the laws of the tribe, were slain also. The quarrel of the dead was taken up by their relatives, and the kindred of the guilty persons were defeated with loss. A series of bloody encounters ensued, till at last the party of the original aggressor were worsted and separated from the tribe.

They were called Hohays, and have been at war with the Daheotahs till within a few years. They now roam over the plains from the Saskashawin to the Missouri, where they live by hunting the buffalo. Their principal resort is about Devil Lake. As well as the Indians farther north-west, they have few guns, or other articles, the manufacture of the whites. Their number cannot be ascertained, but it is certain they exceed a thousand fighting men. A tradition of the Winnebagoes says they were driven from the frontier of Mexico by the Spaniards, towards whom they entertain a hereditary hatred to this day. Within two centuries, they were united with the Otoes, the Toways, and Missouris. They are a fierce, warlike people, and have more national spirit than any other Indians on the frontier. The Otoes and Missouris, now united, are renowned among the tribes of the Missouris for their bravery. They could muster, a few years since, about three hundred men.

The Toways still dwell on the Mississippi. They have from one hundred to two hundred men. The Osages are divided into three tribes, and can boast over one thousand warriors. The Kansas inhabit the plains about the heads of the Arkansas and Red Rivers. Their number is unknown. The Omahaws live high up the Missouri. Besides these tribes, there dwell on the Mississippi, between the River Des Moines, the Wisconsin, and the Missouri, the Sacs and Foxes—a branch of the Chippeway tribe. They speak the Chippeway tongue, and number above one thousand men. On the Missouri are the Pawnees, divided into three tribes, of which the Arikarees are a branch. They live by hunting the buffalo, and are said to have a language of their own. The Mintarees, or Bigbellies, the Mandans, the Crows, and the Blackfeet, also live on the Missouri; and each is said to have a language of its own. Their numbers are unknown. The Shoshonees live between the head waters of the Missouri and Columbia Rivers. They are almost constantly on horseback, and are at war with the lower tribes of the Missouri. On the Columbia River are the Chohunnish, the Skilloots, Echeloots,

Multnomahs, Clatrops, and other tribes. Their haunts and numbers are unknown. They live by fishing as well as hunting, and differ in manners and customs from the tribes east of the Rocky Mountains. They are neither so well fed or clad. Most of these tribes have the practice of flattening the heads of infants between boards, whence the general name of Flatheads. They have some commerce with ships on the north-west coast. Nothing is known of the language of any of these people. In the south of the United States, we have four tribes, viz., the Chickasaws, Choctaws, Cherokees, and Creeks. All these have made some progress in civilization. The Cherokees have a written and printed language, said to be radically different from all others. They number about fifteen thousand souls. The Choctaws and Chickasaws are each more numerous. North of Great Slave Lake is another family of Indians, among which are the Chippewyans, the Copper Indians, the Hare Indians, and the Dog Ribs. Of these the Chippewyans, the Copper Indians, and the Dog Ribs speak the same language. They all wage war with the Esquimaux. The Dog Ribs are also oppressed and persecuted by the Copper Indians, who rob them, and take from them their women, whenever an opportunity occurs. These tribes live by hunting the reindeer chiefly, and by fishing in the winter. Their morals and manners are below the standard of their southern neighbors, and their number is very small. There are also the remnants of some tribes residing within the limits of the United States, viz., the Mohegans, the Delawares, the Shawanoes, the Senecas, the Oneidas, the Piankashaws, and some others. Most of these live by agriculture as well as the chase. Intercourse with the whites has not been advantageous to them. They have learned all the vices of the civilized state without its virtues. Besides all these, there is a tribe in the interior of Newfoundland, who have shunned all intercourse with the whites. The Indians have uniformly resisted all attempts to civilize them, where they could support themselves by the chase. Some few tribes, such as the Southern Indians and the remnants of the Six Nations, having been hemmed in by the whites, and circumscribed in their limits, so as to be unable to live by hunting, have turned to agriculture for subsistence. But such a departure from the habits of savage life is not to be found where there is a possibility of supporting life by other means. The hospitality of Indians is among their most striking qualities. In any of the tribes, a stranger is received with the utmost respect and attention. His person and property are considered sacred.

A pleasing and graphic writer, whose name we have not been able to ascertain, has furnished the following description of Indian manners:—

"With all, or almost all the Indian tribes, the sole care of the men is to provide food. The labor is the exclusive lot of women. The use of the

axe or hoe is considered beneath the dignity of the male sex. It belongs to the females to plant corn, to make and mend garments and moccasons, to build, to pitch tents, cut wood, bring water, to tend horses and dogs, and, on a march, to carry the baggage. The women do not murmur at this, but consider it a natural and equitable distribution of family cares. But they are regarded as an inferior race, and often transferred as property. Polygamy is general. Every man has as many wives as he can support, and, in marriages, the will of the bride is seldom or never consulted. A man addresses himself, indirectly to the parents of his intended wife, and her fate depends on their will. The custom of dowry is reversed among Indians. The man makes certain presents to the parents of his wife, instead of receiving a portion with her. The marriage ceremony is always very simple, and in most tribes there is none at all. Adultery is punished by cutting off the nose, or otherwise mutilating the offending female; sometimes, though rarely, with death. In some tribes, this crime is regarded as a venial fault, and, in very many, the husband lends his wife to a friend, without opposition on her part. Divorces are frequent, and at the pleasure of the contracting parties. In such cases, the wife is usually left to provide for the children as she may. It is no uncommon thing to see an Indian woman who has been five or six times repudiated before she finally settles in life. In some tribes, especially those of Daheotah origin, it is held the duty of each man to marry all the sisters of a family, and to have as many wives as he can support. In most tribes, and we believe in all, incest is held in abhorrence. Instances of devoted attachment are not uncommon. All Indians, of whom we have any knowledge, believe in one Supreme God, and the immortality of the soul. They attribute all good and all power to the Supreme Being. Many tribes also believe in the existence of an intelligent evil principle, whose ill offices they endeavor to avert by prayer and sacrifice. They never ask the Supreme for anything, but merely return thanks for benefits received, saying that he is the best judge of what is for their advantage. They believe in many subordinate deities, two of whom reside in the sun and moon. They attribute supernatural powers to all serpents, especially rattlesnakes, and will kill no animal of the genus. Even the eel escapes on account of his resemblance. They pay religious honors to rocks and venerable objects. They believe that brutes have immortal souls as well as men; and, in short, that all animated nature teems with spirits. In their belief, sorcery is blended with the healing art, and their priests are also physicians and jugglers. These priests practise feats of sleight of hand with all their religious ceremonies; but, with a few exceptions, they have no power or influence over the multitude. The future state of the Indians is a material paradise, where they will follow the same occupations, and enjoy the same delights,

they have experienced in this world. They have also a vague idea of future punishment for sins committed in the body. Among the superstitions of the Algonquin and Dahecotah tribes is a very singular one. A man is sometimes devoted, by his parents or himself, to a life of ignominy. In this case, he dresses like a woman, and performs all female avocations. He associates with women only, and sometimes takes a husband. He is held in utter contempt by all, though his condition be not of his own choice. This condition is frequently owing to a dream of his parents while he is yet unborn. In many tribes men have what they call their *medicine bags*. These are filled with bones, feathers, and other rubbish. To the preservation of their medicine bags they attach much importance. Besides this, each holds some particular animal in reverence, which he calls his *medicine*, and can by no means be induced to kill, or eat when killed, for fear of some terrible misfortune. Moreover, the Indians leave tobacco, worn-out clothing, and other articles, on rocks, as sacrifices to invisible spirits.

"The above is nearly the sum of their religion. It is, we believe, impossible to estimate the number of the North American Indians with any degree of accuracy. It is, however, very small throughout, in proportion to the extent of territory; for a hunting people cannot be very numerous. Their wars, of which we have heard so much, do not materially affect them. They are carried on in detail, by small parties, and consequently are not very destructive. They very seldom give quarter; but when a prisoner is spared, he is sure of being adopted by the conquering tribe. The tribes who inhabit the prairies go to war on horseback, and their weapons are spears and bows and arrows. Those who inhabit the forests are generally armed with guns. Their courage is moral and passive rather than active. They think it cowardice to be affected by calamity, or to give way to passion or feeling. To be always ready and willing to die, and to suffer whatever may befall with constancy, is their idea of the perfection of courage.

"As to government among them, there is none. They have no laws; but there are customs, which every individual scrupulously observes. In cases of murder, for instance, the rule is, blood for blood, and the homicide rarely shuns the penalty of his deed. They have chiefs, but the power of these is limited to persuasion, and they can command no one. Sometimes a chief becomes such in virtue of his achievements in war or his wisdom. In some tribes there is something like hereditary rank; but even then authority does not descend in a direct line. The son of a chief is often set aside, to make room for one more worthy. But in war, implicit obedience is given to the commands of the leader. The tribes that inhabit the prairies all live by hunting the buffalo, mostly on horseback. Those who dwell in wooded countries hunt deer and smaller animals. The more primitive savages are

the poorest, but at the same time the least dependent; for they have few wants, and can supply those few without assistance. Those who live nearer the whites have more of the comforts of life, but are no whit more civilized or happier; for their enjoyments are not multiplied. We may say, that if the Indian trade of the Mississippi were interrupted for five years, all the aborigines of that quarter would be in danger of perishing, as they depend on the whites for clothing and weapons. The Indians can never be dangerous, as there is no union among them. They have no letters, unless we count a few rude hieroglyphics as such. On the whole, we may speak of them as a brave, reckless, generous, and unfortunate people. The Indians in the southern part of North America have been subject to the Spaniards, and are now dependent on the Republics of Mexico and Gautemala, if we except some tribes, such as the Apaches, the Nabajoas, and the Mosquitos. The independent tribes of the north of Mexico resemble those of the United States in manners and customs. Living by the chase and plunder, and provided with fleet horses, they harass the frontiers and hunters. On the coasts of Yucatan, the Indians live by hunting, fishing, and the trade in dye-wood. The extensive ruins of cities in Mexico prove the former extent of its population. The natives possess great muscular force, are well formed, and live to a great age. It is difficult to form an opinion of the character of a people which has been so long subjected to the most cruel oppression. At the time of the conquest, the rich inhabitants of Mexico fell a prey to the rapacity of the Spaniards; and the Aztec priests, who were the depositaries of all the historical knowledge of the country, became the victims of fanaticism."

The Mexican Indians are grave, melancholy, and silent; their music and dances display the same character. The Indians of South America do not differ materially, in their physical characteristics, from those of the northern half of the continent, and, except those of Peru and Chili, are without civilization. In the extensive regions formerly belonging to Spain, they may be divided into two classes—the independent Indians, or Indios bravos, and those who have been reduced to submission. The former are entirely strangers to agriculture; support themselves by the chase and fishing; some of them eat ants, and lizards, and even a kind of mud. The natives of Peru, descendants of the ancient inhabitants of the empire of the Incas, have, as well as those of Columbia, been emancipated since those countries have delivered themselves from the Spanish yoke. Their services were important during the war of the colonies against the mother country. They are, in general, well made and healthy. They are superstitious, wearing amulets on different parts of their bodies. They make a bitter, intoxicating drink from a certain plant, and use poisoned arrows. Their villages are fortified,

and, in case of necessity, they retire into the mountains. The Indians of Chili are mostly independent. Their features are regular, and their complexions are not very dark. Their principal wealth consists in herds of oxen, horses, and guanacos. They pay little attention to agriculture, being nomadic in their habits. They worship the stars, and recognize a Great First Cause. Astronomy is not unknown to them. In Buenos Ayres, the mission of the Jesuits succeeded, in some degree, in civilizing the natives. The tribes of Brazil are numerous; many of them are entirely savage, and both sexes go naked. Their manners and habits are very similar to those of the North American tribes. They live by the chase, which, with war, is the only occupation of the men; the women are the laborers, beasts of burden, servants, &c., of these warlike tribes. Their mutual wars are very sanguinary, and many of them are constantly at war with the Portuguese, while others have entered into friendly connections with them. Some of them have adopted fixed habitations, and practise a rude kind of agriculture; some of them make vases of clay, gather cotton, and make cloth. At the southern extremity of South America are the Patagonians, who have large, nervous frames, a dark complexion, a flat nose, high cheek bones, and a large mouth. The stories of their gigantic size have not been confirmed by the later voyagers.

THE MALAYS (*II. Neptunianus*, Bory).

The vast regions south of the peninsula beyond the Ganges contain those peoples, which, according to Blumenbach, constitute the fourth type of Mankind, and to which is assigned the general designation of *Malays*. They are distributed over the coasts of all the islands of the Indian Archipelago. The innumerable small islands of the Southern Ocean are also peopled by a handsome race, who appear to hold a near relation to the Indians, and whose language has much affinity with the Malay; but in the interior of the larger islands, particularly in the milder portions of them, there exists another race of men, with black complexions and negro faces,—all extremely barbarous,—which are named *Alfourous*; and on the coasts of New Guinea and the neighboring islands is a kind of Negro nearly similar to those of the eastern coast of Africa.

Sir Thomas Stamford Raffles gives this name to a people of Asia who have adopted the religion and language of the Arabians, and intermarried with them, so that they have become separated from their original stock, and form a distinct nation. In the thirteenth century we find the Malays on the Peninsula of Malacca, where they built a city of the same name, and founded an empire. Their sultans subdued Sumatra, where the nation seems to have dwelt previously to their settling in Malacca. They afterwards

possessed themselves of the rest of the Sunda Isles of the Philippines, the Moluccas, and some of the Australian groups, where Malay tribes are found, resembling in their features, religion, and government the Malays of Malacca. At that time they acted a splendid part in Asia; they carried on commerce, in part with their own ships, and planted colonies. Great numbers of ships from China, Cochin China, Hindostan, and Siam filled the harbors of Malacca.

They are now divided into distinct tribes, without any general head. This is partly owing to the superiority which the Europeans, particularly the Dutch, have obtained in the Indian Seas, and partly to the feudal system of the Malays, by which the national power has been divided, and a common spirit prevented by the increasing power of the vassals. The superior vassals obey the sultan, or supreme commander, only when they please, and the vassals under them have similar liberty. The great body of the nation consists of slaves; their masters are the oramlai, or nobility, who are independent, and sell their services to him who pays them best. The Malays are different from the Hindoos, Birmans, and Siamese. They are strong, nervous, and of a dark-brown color; their hair is long, black, and shining; the nose large and flat; their eyes brilliant and full of fire. Impetuosity bordering on fury, treachery, impatience of constraint, love of plunder and blood, characterize the Malays of Asia. Those in the islands of Australia are, in general, more gentle, kind, affable, open and honest, and are distinguished by the finest and most symmetrical persons. The Malays of Asia, including the Eidahans and Dejakkese, in Borneo; the Biajos (one of the wildest tribes), and the Macassars, in Celebes; the Harafores, on the Moluccas; the Sabanos, in Magindanio; the Tagats and Pampangoes, in the Manillas; the Bisayans, in the lesser Philippines, have a remarkable resemblance in their features, in their form of government,—a sort of feudal system,—and in violence and cruelty. In general they profess the Mohammedan religion, are fond of navigation, war, plunder, change of place, and of all daring enterprises. Besides the Koran, the Malays have various local laws; each state has its own, relating chiefly to commerce. The maritime code of Malacca was collected as early as 1276, and confirmed by Mohammed Shah, sultan of the country. They pay more respect to their absurd laws of honor than to justice or humanity; and we find force continually triumphing among them over weakness. Their treaties and their promises of friendship continue only as long as the interests which prompted them seem to demand. They are always armed, and are perpetually at war among themselves, or engaged in plundering their neighbors. When they find opportunity, they will attack European and American vessels by surprise, and kill the crews, if they succeed in capturing them. No

free Malay is seen without a dagger. The people, in general, are very skilful in preparing weapons, particularly daggers. Their constant use of opium contributes to infuriate them; and when maddened by its effects, they rush out, with their daggers in their hands, yelling, "Amok! amok!" (i. e., kill! kill!), whence the expression to "run a-muk." The Malays are active only in war, where they are excited only by the thirst of robbery and blood. At home they are indolent, leaving all the labor to their slaves, and despising agriculture.

THE NEGRO (*II. Ethiopicus*, Bory).

The Negro race is confined to the southward of the Atlas chain of mountains; its color is black, its hair crisped, the cranium compressed, and nose flattened. The projecting muzzle and thick lips, says Cuvier, evidently approximate it to the apes; the hordes of which it is composed have always continued barbarous.

The negro formation prevails in Western Africa in the region of the Gambia and Senegal, extending southwards, is most strongly marked in Guinea, and passes gradually over into the Cassire and Hottentot formation. In Eastern Africa, it commences to the south of Abyssinia, prevails in Zanguebar and Monomotapa, though not in general pure. Of the tribes in the more central of Africa little is known. The heat of the climate in all these regions may have some effect on the tint of the skin, but is by no means the only or the principal cause of the black color, since, under the same climates of the torrid zone, there are found all shades of complexion. White men in Africa only become somewhat swarthier, but never black, even in a succession of generations, unless they intermingle with the negroes; and blacks, in other regions and climates, are not found to lose their native hue. The seat of the black color is the rete mucosum, and the external surface of the true skin (cutis); and when the rete mucosum is destroyed, as by disease, &c., the color is lost; so in parts of the body where the epidermis is unusually thick,—the palms of the hands and the soles of the feet,—it is of a lighter shade. Negroes are also distinguished from other races by other external and by some anatomical peculiarities, particularly in the conformation of the cranium. The projection of the whole visage in advance of the forehead; the prolongation of the upper and lower jaws; the small facial angle; the flatness of the forehead, and of the hinder part of the head (occiput), and the compression in the direction of the temples, allowing less space for the brain than in some other varieties; the woolly, frizzled hair; the short, broad, and flat nose; the thick, projecting lips, with many other peculiarities of formation, constitute some of the characteristics of the *Ethiopic* race.

The African tribes of this variety have, in general, elevated themselves so far above the simple state of nature, as to have reduced the lower animals to subjection, constructed settled habitations, practised a rude agriculture, and manufactured some articles of clothing or ornaments. In political institutions they have made no advance, their governments being simple despoticisms, without any regular organization. Their religion is merely the instinctive expression of the religious feeling in its lowest form of fetichism. Their languages are described as extremely rude and imperfect, almost destitute of construction, and incapable of expressing abstractions. They have no art of conveying thoughts or events by writing, not even by the simplest symbolical characters. The Negro character, if inferior in intellectual vigor, is marked by a warmth of social affections, and a kindness and tenderness of feeling, which even the atrocities of foreign oppression have not been able to stifle. All travellers concur in describing the Negro as mild, amiable, simple, hospitable, unsuspecting, and faithful. They are passionately fond of music, and they express their hopes and fears in extemporary effusions of song. The opinion formerly maintained, that they were of an inferior variety of animals, would not now find an advocate, or a convert, even in the ignorance or the worst passions of the whites. Whether they are capable of reaching to the same height of intellectual cultivation as the Europeans, is a question which we need more facts to decide.

The foregoing form Blumenbach's five general divisions of the Human Family. The varieties are so numerous that, with one or two exceptions, we cannot attempt a description of them here, or indeed scarcely refer to them.

THE HEBREWS.

The appellation of *Hebrew*, so far as we can learn from history, was first given to Abraham by the people of Canaan, among whom he dwelt. It seems to have been applied to him on account of his emigration (about 2000 B. C.) from Mesopotamia, beyond the Euphrates, into the land of Canaan (Palestine). Some, however, consider it as a patronymic derived from Heber, great-grandson of Shem, from whom Abraham was descended. Whatever meaning was attached to the term *Hebrews* before the time of Jacob (Israel), it appears afterwards to have been limited to his posterity, and to have been synonymous with Israelites. This singular people, which has exercised a more permanent and extensive influence by its religion, than polished Greece by her taste, or triumphant Rome by her arms; which has survived the last wrecks of its palaces and cities, and the annihilation of its

political existence as a state, and which presents the wonderful spectacle of a race preserving its peculiarities of worship, doctrine, language, and feelings, in a dispersion of eighteen hundred years, over the whole globe, presents to the mere philosopher a not less important subject of contemplation than to the theologian, who reads in its history a series of direct and striking interpositions of Providence. Its history reaches back to the earliest periods of the world; its code of laws has been studied and imitated by legislators of other ages and distant countries; and the two religions, which now divide the greater part of the civilized world, have been ingrafted on the stock planted by the children of Abraham. The Hebrew history begins with the patriarch of the nation, Abraham; but that of the Hebrew state, with the acquisition of Palestine.

Under Abraham, Isaac, and Jacob, they merely formed one nomadic family, whose history exhibits pictures of the wild hunter, the migratory herdsman, and the incipient husbandman; and in which we already find the worship of one God, the rite of circumcision, and other traits of the future nation. It was in Lower Egypt, however, whither Israel had migrated, and where his descendants resided four hundred and thirty, or, according to some, two hundred and fifty years, that they became a powerful nation. Joseph, having become grand vizier of Egypt, assigns his brothers a residence in the fertile Goshen. They increase rapidly, and become formidable to the Egyptian monarchs, who require them to build and inhabit cities. The oppressions to which they are subjected lead them to flee from the tyranny of their hard masters, and they find a leader and deliverer in a lonely exile, who had forty years before committed the crime of slaying an Egyptian officer, and had since resided on the borders of Arabia, tending the flocks of his father-in-law. The number which left Egypt was six hundred and three thousand five hundred and fifty fighting men, exclusive of the Levites. This unarmed, or at least unwarlike crowd, is pursued by the Egyptians, but escapes across an arm of the Red Sea, the waters of which swallow up the chariots and horsemen of the pursuers.

Niebuhr thinks that this passage was effected near Suez, where he himself forded the sea, which is about two miles across. Burckhardt is of the same opinion. The law—a code at once moral, religious, and political—is given to the Hebrews from Mount Sinai; God himself is their Leader, their King; the constitution is strictly theocratic; a violation of it is sacrilege, and is attended with punishments from heaven; the possession of Palestine is assured to them, and they set forward again for the promised land. On arriving at the frontiers of their new country, their spies bring them back word that it is occupied by a fierce and warlike people, and they immediately demand to be led back to Egypt. But Moses determines to

conduct them again into the desert, to form a new generation of bold and hardy warriors; there they pass thirty-eight years as a nomadic nation. After the death of their great lawgiver, on the summit of Mount Nebo, the Hebrews entered the land which contained the bones of their fathers, and the long-promised streams and mountains of their God. Joshua assumed the command, led them across the Jordan, and, after a contest of seven years, obtained possession of the country. This period of four hundred years may be considered as the heroic age of the nation.

The most extraordinary fact in the natural history of this race, is the immutability of its physical characteristics. All written descriptions of early times, relative to the Jewish race, concur in establishing the permanence of their type. We are informed, by modern travellers, that the same features are common in Mesopotamia, their original seat, and also scattered through Persia, Afghanistan, &c., the direction in which, we are taught by the annals of modern times, some descendants of the ten tribes were dispersed, long after the Assyrian captivity in the eighth century B. C. In short, the Jewish features meet one in almost every country under the sun; but it is worthy of special remark, that Hebrew lineaments are found in no region whither history cannot track them, and rarely where their possessors do not acknowledge Jewish origin. Nor will the fact be questioned, we presume, that well-marked Israelitish features are never beheld out of that race; although it has very frequently been contended that Jews in certain climates have not only lost their own type, but have become transformed into other races!

The number of Jews now existing in the world (of those that are regarded as descendants in a direct line from, and maintaining the same laws with, their forefathers, who, above three thousand years ago, retreated from Egypt under the guidance of the lawgiver, Moses), is estimated by Weimer, Wolff, Milman, and others, variously, from three to five millions. In all climates and countries they are recognized as the same race. Weimer, whose statistics are lowest, gives the following:—

"AFRICA.—They are scattered along the whole coast, from Morocco to Egypt, besides being found in many other parts. Morocco and Fez, 300,000; Tunis, 130,000; Algiers, 30,000; Gabes, or Habesh, 20,000; Tripoli, 12,000, &c. Total, 504,000.

"ASIA.—In Mesopotamia and Assyria. The ancient seats of the Babylonian Jews are still occupied by 5270 families, exclusive of those of Bagdad and Bassora. Asiatic Turkey, 330,000; Arabia, 200,000; Hindostan, 100,000; China, 60,000; Turkistan, 40,000; Province of Iran, 35,000, &c. Total, 738,000.

"EUROPE.—Russia and Poland, 608,000; European Turkey, 321,000;

Germany, 138,000; Prussia, 134,000; Netherlands, 80,000; France, 60,000; Italy, 36,000; Great Britain, 12,000, &c. Total in Europe, 1,918,053."

In America, Milman averages them at six thousand only; but this was certainly very far below the mark, even when his book was published, and they have since been increasing with immense rapidity. We should think that an estimate of one hundred thousand, for North and South America, would not be an exaggeration.

This sketch suffices to show how the Judaic race has become scattered throughout the regions of the earth, many families being domiciliated, ever since the Christian era, in climates the most opposite; and yet, in obedience to an organic law of animal life, they have preserved unchanged the same features which the Almighty stamped on the first Hebrew pair created.

THE GYPSIES.

Accounts of the Gypsies offer such curious analogies with those of the Israelites, that it may not be out of place to add a word respecting them.

"Both have had an Exodus; both are exiles, and dispersed among the Gentiles, by whom they are hated and despised, and whom they hate and despise, under the names of Busnees and Goyim; both, though speaking the language of the Gentiles, possess a peculiar tongue, which the latter do not understand; and both possess a *peculiar cast of countenance*, by which they may be, without difficulty, distinguished from all other nations; but with these points the similarity terminates. The Israelites have a peculiar religion, to which they are fanatically attached; the Romas (Gypsies) have none. The Israelites have an authentic history; the Gypsies have no history; they do not even know the name of their original country."

This isolated race is involved in mystery, owing to absence of traditions; though, from their physical type, language, &c., it is conjectured that the Gypsies came from some part of India, but at what time, and why, cannot now be determined. It has been said that they fled from the exterminating sword of the great Tartar conqueror, Timūr Leng (Tamerlane), who ravaged India in 1408–9 A. D.; but there will be found, in Borrow's work, very good reason for believing that they might have migrated, at a much earlier period, north, amongst the Selavonians, before they entered Germany and other countries, where we first trace them. However, we know with certainty that, in the beginning of the fifteenth century (about the time of Timūr's conquest), they appeared in Germany, and were soon scattered over Europe, as far as Spain. They arrived in France on the 17th of August, 1427 A. D. Their number now, in all, has been estimated at about seven hundred thousand, and they are scattered over most countries of the habita-

ble globe—Europe, Asia, Africa, South America, and some few in North America. “Their tents are pitched on the heaths of Brazil, and the ridges of the Himalaya hills; and their language is heard in Moscow and Madrid, in London and Stamboul.” “Their power of resisting cold is truly wonderful, as it is not uncommon to find them encamped in the midst of the snow, in slight canvas tents, where the temperature is 25° to 30° below the freezing point, according to Réaumur,” while, on the other hand, they withstand the sultry climes of Africa and India.

“The Gypsies are the most prominent of numerous and diverse tribes diffused in little groups over the four continents, to whom Prichard’s term, ‘Allophylian races,’ would properly apply. A list might be made of them, their occurrence in islands, remote valleys, and mountain fastnesses, or even amid dense populations, being far more frequent than is generally supposed. In the absence of all record beyond that of modern days,—their existence known only by their discovery,—we refrain from the labor of enumeration, with the sole remark, that to us they all are mementos of the permanence of type, athwart vicissitudes certainly endured, but unrecorded by themselves: each being a relic of some primitive type of man, generally displaced from its geographical centre of creation, that, having served in days of yore the purposes of the Creator, is now abandoned (with so many others, now lost, like the *Guanches*) to its fate, scarcely affording history sufficient for an epitaph.”

THE HINDOOS.

The Hindoos, or Gentoos, are the primitive inhabitants of the East Indies, one of the most ancient nations, distinguished for their humanity, gentleness, industry, and polished by letters and the arts, at a time when most of their Asiatic neighbors were yet only in the first stages of civilization, when the Greeks lay in obscurity, and the people of Europe in general were destitute both of the useful and the fine arts. They form a numerous people, have preserved their national character for thousands of years, even under the dominion of foreigners, and have retained, to the present day, their language, their written characters, their government, religion, manners, customs, and habits of life. They are, in general, of a brownish-yellow complexion, but the higher and richer classes are almost as white as Europeans. They are somewhat above the middle height, well-proportioned, and, in particular, very flexible and dexterous. They are remarkable for their small hands.

Temperance, frugality, hospitality, and obliging manners are the favorable traits in their character. They are reproached with indolence and avarice. They possess great natural talents, but are, at present, deprived

of opportunities for their development. In earlier times, before they were oppressed by a foreign yoke, they had reached a higher degree of civilization, and their country has been considered as the cradle of all the arts and sciences. They practise agriculture, breeding of cattle, fishing, hunting, and mining. They cultivate forests, commerce, and navigation. They manufacture cloths, of a great variety and value, particularly of cotton and silk; among which are the finest muslins, fine shawls, mats, cordovan leather, &c., and are inimitable in dyeing. In the arts of music and painting they are backward; but in dancing, statuary, and architecture, they are more advanced. They are acquainted with arithmetic, astronomy, and chronology, and are very fond of poetry and singing.

The most extraordinary custom of the Hindoos is the burning of widows at the funeral of their husbands—a practice which has prevailed from time immemorial. This burning of the widows exists chiefly in the countries governed by the native princes. The division of the people into several entirely distinct orders, or classes, which has existed from the remotest times, forms the castes. There are four castes, which, to the great disadvantage of cultivation, are essentially and perpetually separate from each other, so that no transition from one to another is possible; no connection between them by marriage, or in any other way, is permitted, and no individual of one class can assume the habits, or engage in the occupations, of another. The distinction is complete, in every sense, hereditary and personal; all the privileges or disabilities are inherited; nor is any one permitted to become what he is destined to be by nature, but he is obliged to become what his birth permits, or to remain what it condemns him to be. The slightest transgression of these laws is punished with loss of castes, and sometimes, in particular cases, with death. Even the difference of food is precisely marked out. The three higher castes are prohibited entirely the use of flesh; the fourth is allowed to eat all kinds, except beef; but only the lowest classes of the fifth caste are allowed every kind of food, without restriction. Thus the lower the rank of a Hindoo, the less he is restricted in his food and drink; but, on the other hand, the other burdensome restrictions increase with the inferiority of rank. The first and noblest caste is called Brahmanes, and is the class of the Brahmunes, or Brahmanes, who are priests, scholars, teachers in schools and academies, lawyers, and state officers. The second noble order is called Cshatriyas, or Chehteree, and is composed of the Cshatriyas, or Rajah-putras, the kings and warriors. They preserve the name Rajah-puts, Rajah-putras, by way of distinction, in their old hereditary dominions in Hindostan. The third noble caste is called Bise, or Vaisyas: it is composed of husbandmen and merchants. The merchants are called Banians, or Wannians. The fourth noble caste is that

of the Soodras, or Shuder, and comprehend the artisans and laborers. Besides these four castes, with their sub-divisions, there are numerous mixed castes, or spurious classes, called Burrum Shunker, which have sprung from the unauthorized unions of individuals of different castes. These mixed races form a transition to the degraded outcasts, — the Parias, Chaclys, and Pelaya, — that is, contemptible, vile, unclean men. These consist of those unhappy wretches who are obliged to do whatever no one else can do without pollution. They are not only considered unclean themselves, but they unclean whatever they touch. They are deprived of all civil privileges, and stigmatized by particular laws, regulating their mode of life, their houses, and their furniture; they are not allowed to visit the pagodas, or temples, of other castes, but have their own pagodas and religious exercises; they are not suffered to enter the houses of the other castes (if it is done inadvertently, or from necessity, such a place is purified by religious ceremonies); they must not appear in public markets, are confined to the use of particular wells, which they are obliged to surround with bones of animals, to warn others against using them; they dwell in miserable hovels, distant from cities and villages, and are under no restrictions in regard to food. To the Hindoos belong the Seiks, Jats, Rajapoots, Mahrattas, the Singalese, &c., of whom some have gone over to the Mohammedan religion; others, like the Seiks, have a religion of their own.

THE PHœNICIANS.

Among the most ancient peoples of antiquity the Phœnicians occupy a high place, by their commercial enterprise, their inventive genius, and the perfection to which they brought many arts, especially that of architecture. Located on a narrow strip of land lying between the ocean and the ranges of the Lebanon, and forming part of the Syrian coast, in width nowhere exceeding five geographical miles, and in length not above thirty-five, this people, through the sole agency of commerce and navigation, spread their dominion not only over Cyprus and Crete, and the smaller islands of the Archipelago in their more immediate vicinity, but along the shores of the Mediterranean — in Northern Africa, in the islands of Sardinia and Sicily, and in the southern and western parts of Spain. But beyond even these points the trading-vessels of the Phœnicians reached shores and established commercial depots in countries the names and localities of which were unknown to, and by them carefully concealed from, their contemporaries; as, for instance, the Island of Madeira, the coasts of England and Ireland, and the Baltic coasts of Russia. Around Sidon and Tyre, and many other Phœnician cities and colonies, the Old Testament has shed the glowing tints of Oriental phraseology, familiarizing us with their splendor and their great-

ness; but the Phœnician colonies in Africa surpassed in magnificence and power the parent country.

According to an ancient inscription in the Phœnician language, which says, "We have fled from the robber Joshua, the son of Nim," and which was discovered in Numidia A. D. 540, the first Phœnician colonies in Northern Africa must have been founded as early as the year 1490 B. C.,—a circumstance which is by no means improbable when we consider that in the book of Joshua, Sidon is already mentioned among the mighty princes, and that the Phœnician colonies of Utica, Hadrumetum, Hippo, Leptis, and others, are known to have existed on the northern coast of Africa centuries before Dido there founded the city whose fame was soon to eclipse that of all the older daughters of Sidon and Tyre.

On the northern coast of Africa, near where the city of Tunis now stands, about the year 878 B. C., and one hundred and twenty-five years before the foundation of Rome, she founded the city of Carthage, which soon gave promise of its future greatness. A tribute for the soil was paid the natives. The people of the neighboring territories were induced, by the offer of great commercial advantages and of the rights of citizenship, to join the new comers; and every means for promoting the prosperity of the new settlement so effectually taken, that even during the lifetime of Dido the city had acquired so much importance in the eyes of the neighboring nations, that the hand of the princess was sought in marriage by a powerful Numidian prince, who threatened to have recourse to violent measures in case his suit were not accepted. To secure the independence of her new-founded city, and to keep her faith to her deceased husband, Dido, acting in accordance with the received opinions of her country, and the principles of her religion, threw herself into the flames of a funeral pyre, which she had ordered to be lighted for her, and was ever afterwards worshipped as a deity by her people.

The first periods of Phœnician greatness are veiled in the mysterious darkness of an unknown past; yet so much is certain, that their date must have been very remote; as, according to the accounts which Herodotus received from the priests, the foundation of Tyre took place thirty centuries before the Christian era.

Long before the expedition of the Argonauts, the Phœnicians had already founded colonies on the Bithynian coast of the Black Sea (*Pronectus Bithynian*); and that at a very early time they must have steered through the Straits of Gades into the Atlantic is proved by the fact, that as far back as the eleventh century before Christ they founded the towns of Gades and Tartessus on the western coast of Southern Spain. Penetrating farther and farther to the north, they discovered Britain, where they established their

chief station on the Scilly Isles, at present so insignificant and obscure, and even visited the barbarous shores of the Baltic in quest of the costly amber. They planted their colonies along the north-west coast of Africa, even beyond the tropic; and two thousand years before Vasco da Gama, Phœnician mariners are said to have circumnavigated that continent; for Herodotus relates that a Tyrian fleet, fitted out by Necho II., Pharaoh of Egypt (611-595 B. C.), sailed from a port in the Red Sea, doubled the southern promontory of Africa, and, after a voyage of three years, returned through the Straits of Gades to the mouth of the Nile.

Less wonderful, but resting on better historical proof, is the celebrated voyage of discovery to the south, which Hanno performed by command of the senate of Carthage, the greatest of all Phœnician colonies, eclipsing even the fame of Tyre itself. Sailing from Cerne, the principal Phœnician settlement on the western coast of Africa, and which was probably situated on the present Island of Arguin, he reached, after a navigation of seventeen days, a promontory which he called the West Horn (probably Cape Palmas), and then advanced to another cape, to which he gave the name of South Horn, and which is manifestly Cape de Tres Puntas, only five degrees north of the line. During daytime the deepest silence reigned along the newly-discovered coast, but after sunset countless fires were seen burning along the banks of the rivers, and the air resounded with music and song, the black natives spending, as they still do now, the hours of the cool night in festive joy. Most likely the Canary Islands were also known to the Phœnicians, as the summit of the Peak of Teneriffe is visible from the heights of Cape Bojador.

The progress of the great mariners of old in the Indian Ocean was no less remarkable than the extension of their Atlantic discoveries. Far beyond Babel-el-Mandeb their fleets sailed to Ophir, or Supara, and returned with rich cargoes of gold, silver, sandal-wood, jewels, ivory, apes, and peacocks, to the ports of Elath and Ezion-Geber, at the head of the Red Sea. These costly productions of the south were then transported across the Isthmus of Suez to Rhinocolura, the nearest port on the Mediterranean, and thence to Tyre, which ultimately distributed them over the whole of the known world.

The true position of Ophir is an enigma which no learned *Oedipus* will ever solve. While some authorities place it on the east coast of Africa, others fix its situation somewhere on the west coast of the Indian Peninsula; and Humboldt is even of opinion that the name had only a general signification, and that a voyage to Ophir meant nothing more than a commercial expedition to any part of the Indian Ocean, just as at present we speak of a voyage to the Levant, or the West Indies.

But whatever Ophir may have been, it is certain that the Phœnicians

carried on a considerable trade with the lands and nations beyond the gates of the Red Sea. Their trade in the direction of the Persian Gulf was no less extensive. Through the Syrian Desert, where Palmyra, their chief station or emporium proudly rose above the surrounding sands, their caravans slowly wandered to the banks of the Tigris and Euphrates, to provide Nineveh and Babylon with the costly merchandise of Sidon and Tyre. Following the course of the great Mesopotamian streams, they reached the shores of the Persian Gulf, where they owned the ports of Tylos and Aradus, and the rich pearl islands of Bahrein, and, having loaded their empty camels with the produce of Iran and Arabia, returned by the same way to the shores of the Mediterranean. How far their ships may have ventured beyond the mouth of the Persian Gulf is unknown; but the researches of the learned Orientalists, Gesenius, Benfey, and Lassen, render it extremely probable that, taking advantage of the regularly changing monsoons, they sailed through the Straits of Ormus to the coast of Malabar.

The progress of the Phoenician race in the technical arts, as well as in the astronomical and mathematical sciences, so highly important for the improvement of their navigation, was no less remarkable for the age in which they lived, than the vast extension of a commercial intercourse which reached from Britain to the Indus, and from the Black Sea to the Senegal. They wove the finest linen, and knew how to dye it with the most splendid purple. They were unsurpassed in the workmanship of metals, and possessed the secret of manufacturing white and colored glass, which their caravans and ships exchanged for the produce of the north and of the south. By the invention of the alphabet, which, with many other useful sciences and arts, they communicated to the Greeks and other nations with whom they traded, they no less contributed to the progress of mankind than by the humanizing influence of commerce.

Thus, when we consider the services which these merchant-princes of antiquity rendered to their contemporaries, wherever their flag was seen or their caravans appeared, the annihilation of the maritime power of Tyre by Alexander (332 B. C.), and the destruction of Carthage by the Romans (146 B. C.), must strike us as events calamitous to the whole human race. Had the Carthaginians, so distinguished by their commercial spirit and ardor for discovery, triumphed over the semi-barbarous Romans, who, then at least, had not yet learned to imitate the arts of plundered Greece, there is every probability that some Punic Columbus would have discovered America at least a thousand years sooner, and the world at this day be in possession of many secrets still unknown, and destined to contribute to the comforts or enjoyments of our descendants.

In the times of Homer, when the Indian Ocean and the Atlantic had long

been known to the Phœnicians, the geographical knowledge of the Greeks was still circumscribed by the narrow limits of the Eastern Mediterranean and part of the Euxine, and many a century elapsed ere their ships ventured beyond the Straits of Gades. Colæus, of Samos (639 B. C.), is said to have been the first seafarer of Hellenic race who sailed forth into the Atlantic, compelled by adverse winds, and was able on his return from his involuntary voyage to tell his astonished countrymen of the wondrous rising and falling of the oceanic tides. It was seventy years later before the Phœnicians of Massilia, the present Marseilles, ventured to follow the path he had traced out, and to visit the Atlantic port of Tartessus.

The town of Massilia had the additional honor of reckoning among her sons the great traveller Pytheas. This far-wandering philosopher, who lived about three hundred and thirty years before Christ, had visited all the coasts of Europe, from the mouths of the Tanais, or Don, to the shores of the Ultima Thule, which, according to Leopold Von Buck, was not Iceland, nor Feroe, nor Orcadia, but the Norwegian coast. His narrative first made the Greeks acquainted with North-western Europe, and remained, for a long time, their only geographical guide to those hyperborean lands.

We give below the leading varieties of Man, according to Dr. Prichard.

"On comparing the principal varieties of form and structure which distinguish the inhabitants of different countries, we find that there are seven classes of nations which may be separated from each other by strongly-marked lines. Among their principal characteristics are peculiar forms of the skull; but these are by no means the only difference which require notice and particular description. These seven principal classes are, first, those nations which in the form of their skulls and other physical characters resemble Europeans, including many nations in Asia, and some in Africa; secondly, races nearly similar in figure, and in the shape of the head, to the Kalmucks, Mongoles, and Chinese. These two first classes of nations will be designated, for reasons to be explained, Iranian and Turanian nations, in preference to Caucasian and Mongolian. . . . The third class are the native American nations, excluding the Esquimaux, and some tribes which resemble them more than the majority of inhabitants of the New World. The fourth class comprises only the Hottentot and Bushman race. A fifth class are the Negroes; the sixth, the Papuas, or woolly-haired nations of Polynesia; the seventh, the Alfourou and Australian races. The nations comprised under these departments of mankind differ so strikingly from each other, that it would be improper to include any two of them in one section, and there is no other division of the human family that is by physical traits so strongly characterized. There are, indeed, some nations that cannot be

considered as falling entirely within either of these divisions, but they may be looked upon as approximating to one or another of them."

On the above, the editor of the last edition of Cuvier's Animal Kingdom offers the following observations:—

"It appears to be conclusively proved that barbarism and insufficient nourishment tend, in a few generations, to deteriorate the physical characters of even the highest races of mankind, by increasing the facial angle, &c., while the reverse induces proportional improvement. Still there is reason to suspect that the diversities which are thus occasioned are restrained within moderate limits; and this remarkable fact must be borne in mind (which I believe has not been hitherto stated), that while an artificial mode of life would seem to have produced those acknowledged *varieties* of species which are noticeable among such of the lower animals as have been domesticated, we observe very dissimilar races of human beings among those whose manner of living is least artificial of any, and which, furthermore, in numerous instances, inhabit the same countries, besides being widely diffused; thus proving that climate and locality exert less influence than has been imagined. This most difficult subject of inquiry, in fine, is endlessly perplexed, and, in several instances, rendered quite inextricable, by the occasional blending of two or more diverse races, in every degree of proportion. There are also decisive proofs (afforded by architectural relics scattered over Siberia and both Americas) of great nations having been utterly exterminated; whose very names have perished; and if civilized, or comparatively civilized, populous nations have thus become so completely sunk in oblivion, that we infer their former existence only as that of some lost tribes of animals can be recalled, how very many hordes of savages, who erect no memorials, may have been extirpated, and are forgotten irretrievably! Hence the extreme and apparently insuperable difficulties, which, it is probable, will continue to oppose the definitive solution of the intricate and peculiarly interesting problem which we have been considering."

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